STATISTICAL PROCEDURES TO DETERMINE SEASONAL FACTORS FOR TRAFFIC VOLUME MONITORING IN WEST VIRGINIA

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Final Report
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Technical Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.

4. Title and Subtitle
Statistical Procedures to Determine Seasonal Factors for Traffic Volume Monitoring in West Virginia

5. Report Date
October 1997

6. Performing Organization Code

8. Performing Organization Report No.

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10. Work Unit No. (TRAIS)

11. Contract or Grant No.

13. Type of Report and Period Covered
Final

12. Sponsoring Agency Name and Address
West Virginia Department of Transportation
US Department of Transportation, Federal Highway Administration

14. Sponsoring Agency Code

15. Supplementary Notes
Sponsored by a grant from U.S. Department of Transportation, Federal Highway Administration and West Virginia Division of Highways

16. Abstract

West Virginia Division of Highways (WVDOH) collects traffic counts at selected sites throughout the state. Some of these counts are continuously taken at permanent sites and some are from short duration counts. Clearly, it is extremely important for the WVDOH to organize the massive data collected into a usable format and have the capability to generate 'information' that can be used by planners and decision makers.

In this research, data collected at permanent sites were statistically analyzed to reveal similarities in traffic patterns and to 'cluster' similar counters in smaller groups. These clusters can be further analyzed to point out more details and reveal the nature of their 'seasonality patterns.' The range of options available in terms of the variety and details of statistical analysis is vast. However, practicality and the potential for usefulness of information generated must always guide our efforts in data manipulation and analysis. Also, keep in mind that in spite of mathematical rigor associated with the statistical analysis performed, personal judgement in some instances must be used to make sure that results are reasonable and useful.

Results of the clustering used to compute the seasonal factors are shown in Appendix 8. This appendix must be consulted to convert the short term count taken at a certain location to the AADT for that location.

17. Key Words	18. Distribution Statement
Seasonal Factors, Traffic Count, AADT, Cluster Analysis	

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified		

ACKNOWLEDGMENTS

This research project, sponsored by the U.S. Department of Transportation Federal Highway Administration and the West Virginia Department of Transportation, Division of Highways, was completed with the assistance of many individuals and organizations. The investigators wish to express their thanks to those identified below, as well as, all of the other individuals and organizations that supported the project.

The support provided by the West Virginia Division of Highways is appreciated. Mr. Jerry Legg deserves special thanks for his overall guidance and monitoring of the project. His comments throughout the project were very helpful to us. The authors would also like to acknowledge Mr. Larry Griffith for his assistance and comments.

Comments and ideas that the authors received from Mr. Jack Justice of the FHWA were very helpful and are highly appreciated.

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CHAPTER ONE

1.1 INTRODUCTION

One of the most fundamental tools in planning, design and management of highway systems in any state is the traffic volume calculation. Decisions on the allocation of highway funds to various highway development projects depend on the projected traffic volume and the type of usage made of a highway. Accurate forecasts of future growth in highway traffic is an essential component in making decisions whether to construct a new highway or to expand and operate existing highways more efficiently. These forecasts are based on traffic counts made during the year at various locations in the state. The raw counts obtained by the Automatic Traffic Recorders (ATR's) must be processed and statistically analyzed to yield annual vehicle miles of travel (AVMT) and average annual daily traffic (AADT). AVMT is basically a system measure, while AADT is a point-specific measure.

Several publications by the Federal Highway Administration deal with these specific issues as part of the Highway Performance Monitoring System (HPMS) in each state. In Reference 1, Traffic Monitoring Guide, it is mentioned that statistical procedures must be used to estimate AADT. These procedures involve seasonal (monthly) factors, adjustments for day of week, axle correction factors, and growth factors. Section 3 of the Guide is devoted to the explanation of some of the statistical methods that can be used to develop various elements of a traffic volume monitoring system. These procedures are compatible with those outlined in Reference 2, Guide for Traffic Counting Manual, by the FHWA. It is important to emphasize that the accuracy of the AADT and

AVMT estimates are directly related to the appropriateness and correct implementation of statistical procedures used to estimate the seasonal factors that go into the calculation of these estimates.

1.2 RESEARCH OBJECTIVES

Specific objectives of this research are:

1. To investigate statistical procedures that can be used to calculate seasonal factors and day of week adjustments.
2. To identify data elements that must be collected and used as inputs to such procedures.
3. To streamline the process of development of seasonal factors to expand short-term counts to AADT, as specified in Section 3, Chapter 2 of the Traffic Monitoring Guide (1).
4. To provide statistical help to the personnel at WVDOH Planning department involved in traffic volume estimation to enable them to perform the appropriate analyses and implement and maintain the systems developed.

1.3 RESEARCH METHODOLOGY

In order to meet the project objectives, the following research plan was followed.

1. Meet with WVDOH in Transportation Planning to clearly identify the specifications and exact capabilities desired to be included in the proposed procedures.
2. Perform a thorough search of the literature on seasonal traffic factors, their use in traffic volume forecasting and all relevant FHWA publications that deal with this subject.
3. Investigate the seasonal traffic factors and adjustment procedures that are currently used in states that are mostly rural.

4. Develop guidelines and procedures for data collection and analysis for the calculation of seasonal factors. These procedures will be compatible with the recommendations and procedures suggested by the FHWA (Reference 1), and others that may apply. Also, the research team will coordinate this step with WVDOH Planning Division personnel such that all procedures, to the maximum extent possible, make use of the data being currently retrieved from the ATR's.

5. Document the system developed such that it can be implemented and maintained by the WVDOH, Transportation Planning personnel.

1.4 ORGANIZATION

This report is organized into four chapters. Each chapter has a different area of focus. Chapter Two contains some background information on traffic count elements, data description, and a brief discussion of the experiences of two neighboring state highway agencies.

Chapter Three contains the methodology used in the statistical analysis and the results of the research. A discussion of statistical procedures for determining the seasonal factors is included in this chapter.

Chapter Four consists of recommendations and conclusions. Recommendations for future work will also be discussed.

CHAPTER TWO

2.1 BACKGROUND

Highway traffic monitoring is the measurement, summarization, and reporting of vehicle characteristics. There are critical decisions related to each of these activities. Effective highway traffic monitoring ensures that road construction projects are appropriately designed, traffic safety problems are accurately identified, and highway funds are equitably allocated .

Traffic data are used in a variety of ways by state departments of transportation. Decisions for the design and engineering of highways, methods of improving highway safety and usage, environmental and air quality considerations, can (and should) all be based on information obtained from traffic counts. Also, a database of traffic data in a state can be used to provide information that can be used for business location and industrial expansion. Service industries, such as restaurants and motels, depend heavily on the traffic volume and accuracy of current data, and forecasts for future growth is of special interest to them.

Traffic volume estimates are calculated in various manners. Generally, estimates are derived from data obtained by both permanent and temporary traffic counting stations. Statistically, this estimation can be quite complicated, leaving even the brightest statisticians disagreeing over practices and procedures. More importantly though, is the fact that these statisticians may not be dealing with accurate data in the first place, making it nearly impossible to generate accurate forecasts.

Various traffic counting devices and manual counts will not always yield identical results. Differences in clock time, sensitivity of recording devices to vehicle pass-over, multiaxle vehicle

proportions, and mechanical equipment failure or malfunction all combine to produce error (9). In August of 1981, a comparison of the following four counting methods was conducted by the New York Department of Transportation Planning Division at a single location for a 24 hour period (9):

1. manual counting,
2. portable road-tube counters,
3. fixed mechanical continuous counter using induction loops, and
4. a telephone-based counter system using the same induction loops.

The findings of this study were:

1. There is no such thing as an accurate traffic count; clock error, machine error, percentage of trucks, and other factors are likely to cloud the reliability of any count.
2. Manual counts are likely to contain considerable errors, particularly if conducted by inexperienced or unsupervised personnel.
3. Counts taken with a road-tube counter will overestimate traffic volume depending on the percentage of trucks. Such counts should be adjusted for the multiaxle truck percentage and checked closely for clock accuracy.
4. Counts should be taken for at least 24 hours to minimize overall clock error. Even during longer count periods (one day to three weeks), counters are not likely to give similar results, but the differences will be smaller.
5. Both the continuous counter and the telemetry system show very similar, but not identical results.

Hence, the accuracy of the raw counts is certainly an area of concern.

Another difficulty is that current traffic monitoring practices in the United States are very

diverse (3). These diverse practices stem, in part, from belief in the following three myths: there is no need to establish traffic monitoring standards because current practices are typically consistent; there is no need to establish standards because there would not be a substantial difference in the resulting traffic summary statistics; and there is no need to establish standards because the differences in resulting summary statistics would not have a significant impact on the applications of the statistics (4). Due to these diverse practices, it is very hard for much information to be shared between agencies.

If various states and agencies were able to share their knowledge, traffic monitoring in the United States would reach a new level of efficiency. For this to occur, a commitment must be made to honor Truth-In-Data practices. Truth-In-Data is the documentation and disclosure of the procedures used to collect, edit, and summarize traffic data. It is also the estimate of statistical confidence in reported traffic summary statistics (5). While it is often believed that honoring Truth-In-Data practices makes little practical difference, this is simply not true. In New Mexico, a study was conducted to determine what effects data integrity have on the analysis of the underlying distribution of the data and on other summary statistics. The results suggested that traffic volume summary statistics may be distorted by assumptions concerning equipment failure insignificance, data imputation, and data smoothing (6).

In the Traffic Monitoring Guide, the Federal Highway Administration has outlined procedures for the development of a statistical sampling program for the estimation of traffic volume, annual vehicle miles of travel, annual average daily traffic, vehicle classification, and truck weight with known reliability (1). The development of this sampling program has clearly defined steps:

1. Definition of desired objectives
2. Establishment of cost limits or precision requirements
3. Definition of the universe to be sampled
4. Definition of sampling element
5. Determination of reporting stratification desired
6. Estimation of sampling element variability
7. Development of sample design
8. Implementation of sample design
9. Development of estimation procedures

While the Guide acknowledges that this task can be enormously complex, the results are quite important in pursuing the goal of highway efficiency.

2.2 ADJUSTMENT FACTORS

Three basic types of traffic-counting operations are commonly employed by state highway departments to obtain annual daily traffic estimates (7). Continuous counts are taken by ATR's, but only at a limited number of locations due to the significant equipment expense. Secondly, in some states, intermittent or seasonal-control counts are taken 4, 6, or 12 times a year for durations varying from 48 hours to 2 weeks. The greatest amount of traffic data, however, results from short coverage counts taken for durations varying from 24 hours to 7 days. It is necessary to utilize these coverage counts to arrive at AADT estimates for the many locations on the highway network where continuous recorders and seasonal-control stations are not operated (7).

Historically, highway departments have employed some factoring procedure for adjusting

coverage counts to form estimates of AADT. The general procedure is to somehow relate all sections of highway to a continuous counter or group of continuous counters. Then, data obtained from the permanent counter(s) are used to calculate factors, which are applied to the data generated at the corresponding coverage count sites.

One specific procedure for estimating annual average daily traffic from short-term traffic counts for rural roads carrying 500 or more vehicles per day has been advocated by the U. S. Bureau of Public Roads (BPR), in its Guide for Traffic Counting Manual published in 1965. The BPR procedure was based on grouping together the permanent counting stations that have similar annual patterns of monthly traffic adjustment factors (8). The continuous counting stations are grouped in such a way that, for the stations within a single group, the difference between the smallest and largest monthly factor for any month considered does not exceed 0.20 (9). All sections of the rural highway system are then assigned to one of these groups and the appropriate adjustment factor is applied to the short-term counts (8).

A similar procedure used by the Missouri State Highway Department has produced useful results. This method, is highly subject to individual judgement. The individual needing the estimate of AADT at the location of a coverage count selects a continuous count station which he/she believes to have a similar annual pattern of monthly traffic variations (8). The factors are then calculated from the continuous data and applied to the short-term data in the same way as the BPR procedure. The BPR's procedure has the advantages of objectivity and a statistical measure of accuracy.

Again, a similar procedure is employed by the Pennsylvania Department of Transportation (10). They employ sixty ATR's, located at various points across the state. These sites are categorized into one of ten Traffic Pattern Groups (TPG's). The TPG's are based on functional

classification, geographic area, and urban/rural characteristics. The grouping of the data collected at the ATR sites provides a means to compute daily, monthly, and other factors by functional classification and geographic location. Specifically, these factors are computed by group, for each day of the week for each month. All 24-hour short-term counts are associated with one of the ten groups and then processed to an Annual Average Daily Traffic (AADT) through the application of a "day of week by month" factor. If the short-term count to be analyzed was taken earlier than the current year, a growth factor is also applied to project the older data to a representative current year estimate. If an estimate of peak-hour volume is desired, the k-factor (Design Hour Volume Factor) would also be applied.

In general, adjustment factors can come in the form of annual growth factors, day-of-week factors, or monthly factors. Axle correction factors may also be desirable. These factors are simply ratios of AADT's, taken from continuous count stations, at different points in time. The annual growth factor is a ratio of AADT for year t to AADT for year t-1. The day-of-week factor is a ratio of average AADT to average AADT for a certain day of the week. Similarly, the monthly factor is simply a ratio of AADT to average AADT for a certain month. When computing monthly factors, it might be advantageous to calculate factors with and without weekends.

2.3 APPLICATION OF FACTORS TO SHORT-TERM COUNTS

As part of an in-depth evaluation for the Washington State Department of Transportation (WSDOT), procedures were developed to derive estimates of annual average daily traffic (AADT) from short-duration axle counts, in hopes of realizing considerable cost savings by using small sample sizes, consisting of only three days (11). The author states that "A rigorous statistical

approach to statewide data collection and program design permits the estimation of data precision and can provide a rational basis to assist in allocating limited resources among the various possible data collection activities" (11). The model, which is quite simple, is as follows:

$$AADT = VOL(F_S)(F_A)(F_G)$$

where VOL = average 24-hr volume from a standard WSDOT 72-hr Tuesday-Thursday short count

F_S = seasonal factor for the count month

F_A = weekday axle correction factor if VOL is in axles; equal to 1 if VOL is in vehicles

F_G = growth factor if VOL is not a current year count; equal to 1 otherwise

In Pennsylvania they currently have 63 permanent, volume-counting ATR sites, which are categorized into ten traffic-pattern groups. The ten groups are as follows: urban interstate, rural interstate, urban principal arterial, rural principal arterial, urban minor arterials and collectors, north rural minor arterial, central rural minor arterial, north rural collector, central rural collector, and special recreational. (They also have eight sites that collect both volume and vehicle classification data, and one site that also collects weight data.) After the ATR data is edited and unknown data imputed, seasonal adjustment factors are computed for each group, by day of the week for each month. When a 24-hour short-term count is made, the site of the count is associated with one of the ten groups. The seasonal adjustment factor(s) for that group are then applied to the short-term count to obtain AADT estimates.

2.3 DATA COLLECTION IN WEST VIRGINIA

West Virginia Division of Highways (WVDOH) maintains 51 ATR sites. The counts collected by these ATR's are accumulated and stored for further processing. Daily and monthly factors are then calculated for each site. The sheer volume of these data necessitated the development of a management information system for summarizing data, editing, and generating appropriate reports. This MIS is currently undergoing its final stages of testing and will be put into production mode in the near future.

For the purposes of this project, however, data for 1995 calendar year was used. The data set consisted of the traffic count for 51 sites. Each site was also assigned a "Functional Classification Code" based on the standard definition given in the Traffic Monitoring Guide (1), and as designated by the WVDOH. Highways are classified into Rural and Urban categories each having their own sub-categories. The following listing is reproduced from the Traffic Monitoring Guide.

RURAL

Code	Functional Classification
01	Principal Arterial - Interstate
02	Principal Arterial - Other
06	Minor Arterial
07	Major Collector
08	Minor Collector
09	Local System

URBAN

11	Principal Arterial - Interstate
12	Principal Arterial - Other Freeways or Expressways
14	Principal Arterial - Other
16	Minor Arterial
17	Collector
19	Local System

The Traffic Monitoring guide prescribes that grouping of the ATR's be based on various criteria including statistical and expert opinion. However, it also recommends to use at least the following number of groups:

Description	**Functional Code**
Interstate Rural	1
Other Rural	2, 6, 7, 8
Interstate Urban	11
Other Urban	12, 14, 16, 17
Recreational	Any

To identify an ATR site as recreational, one must examine the pattern of change in traffic volume during various months of the year. The coefficient of variations for these stations is usually high (more than 25%) which indicates a high degree of seasonality.

Table 2.1, below, shows a list of the counting stations, as extracted from the 1995 worksheet used for this project. The functional code (FC) for each station is also given. Note that stations 401 and 402 are installed on the north-bound and south-bound lanes of I-77 in Wood county. Also, stations 351 and 352 are on the west-bound and east-bound lanes of US 52 in McDowell county. For the purposes of statistical analysis, data for these stations were combined as if there is only one station at each location.

TABLE 2.1 List of Traffic Counting Stations and Their Location

FC	Station ID	COUNTY	LOCATION
1	1	Summers	I-64, 1.0 MI. W. OF WV 20
1	2	Cabell	I-64, 1.5 M W OF CO 60/89
1	3	Kanawha	I-77, 2.1 MI N. OF CO 15
1	401	Wood	I-77 NB, 1.0 M S OF WV 14
1	402	Wood	I-77 SB, 1.0 M S OF WV 14
1	5	Braxton	I-79, 0.8 MI. N. OF US 19
1	6	Harrison	I-79, 0.2 M S OF CO 73/73
2	7	Tyler	WV 2, 2.9 MI. OF CO 2/2
2	8	Nicholas	US 19 .06 M OF CO 19/45
2	9	Wood	US 50, 1.1 MI. E. OF I-77
2	10	Greenbrier	US 60, 0.1 M W OF CO 60/4
2	11	Boone	US 119, 0.8 MI. S OF WV 3
6	12	Harrison	WV 131, 1.2 M OF US 50
6	13	Wayne	WV 152, 0.4 M OF CO 52/1
6	14	Lewis	US 33, 0.4 MI. E OF CO 13
6	15	Putnam	US 35, 0.3 MI. OF CO 27
6	16	McDowell	US 52 0.5 M E OF CO 52/17
6	17	Logan	US 119, 1.1 MI S OF WV 10
6	18	Rndolph	US 219, 1.5 MI OF CO 56
7	19	Jackson	CO 21 0.4 M W OF CO 33/12
7	20	Grant	US 220 1.5 M S OF 220/4
7	21	Pendelton	WV 28, 0.2 MI. OF US 33
7	22	Braxton	US 19 1.5 M OF CO 19/36

7	23	Raleigh	US 19, 0.4 M S Of CO 40/2
7	24	Ohio	US 40, 0.2 MI. W OF CO 41
7	25	Cabell	US 60, 0.1 M W OF CO 25/1
11	26	Wayne	I-64, 1.5 MI. E. OF US 52
11	27	Kanawha	I-64, 2.0 MI W OF WV 622
11	29		I-70, 0.5 MI. W. OF US 40
11	30	Raleigh	I-77, 0.3 MI. S. OF WV 3
12	31	Marshall	WV 2, 0.6 MI. S. OF CO 17
12	32		US 50 0.4 M W OF CO 50/40
14	33	Cabell	WV 10, 0.3 MI. S. OF I-6
14	34	Kanawha	WV 25, 1.0 MI W OF WV 622
14	351	McDowell	US 52WB, 0.6 M W OF CO 29
14	352	McDowell	US 52EB, 0.6 M W OF CO 29
14	36	Kanawha	US 60, 0.2 MI. W OF CO 85
16	37	Berkeley	US 11, 1.5 MI. S OF WV 45
17	38	Kanawha	WV 61, 1.4 M S OF I-77 KC
1	39	Cabell	I-64, 1.0 MI. W. OF WV 34
16	40	Kanawha	WV 114, 0.5 M CO 114/1
16	41	Kanawha	US 119 0.4 M S CO 119/16
11	42	Kanawha	I-64, E. OF KAN. CITY I/C
7	43	Logan	WV 44, 0.5 MI S OF US 119
6	44	Boone	WV 94, 0.3 MI. N. OF WV 3
7	45	Wetzel	WV 7, 0.2 MI. E. OF WV 2
7	46	Randolph	US 250 0.6 M S OF CO 56/1
1	47	Mercer	I-77, 0.9 MI. S 0F WV 112
6	48	Mercer	WV 20 0.1 M W OF CO 20/12
6	49	Pocohontas	WV 92, 2.6 MI. S OF WV 39
1	50	Berkeley	I-81, 1.6 MI. S. OF WV 45
7	51	Nicholas	WV 20, 0.6 MI. S OF WV 55
1	53	Preston	I-68, 1.0 MI. W. OF WV 26

2.4 DATA PREPARATION

As mentioned before, data for this project were provided in the form of a Lotus 123 worksheet that contained the 1995 counts for the permanent sites. At each site, counts were recorded for every day of the year. Given the traffic for each day of the week and each month, it would be possible to compute daily and monthly factors for each site. In some cases, due to factors such as equipment malfunction, there were gaps in the data. In order to be able to count the specific number

of days missing in each month, each day of the week was assigned a number starting with Sunday as day 1. Then, the following steps were taken in sequence:

1. The sum of traffic counts for all days of each month were calculated.
2. Monthly Average Daily Traffic (MADT) for each month was calculated by dividing the total count for the month by the number of days in that month for which data were available.
3. Day-of-the-week factors per month were computed by dividing the MADT for the month by the average traffic count for that day of the week in that month.
4. The sum of traffic count for the whole year was computed.
5. Annual Average Daily Traffic (AADT) was computed by dividing the total count for the year by the number of days in the year for which data were available at that station.
6. Monthly factors (F1 through F12) were calculated as the ratio of AADT to MADT.
7. Coefficient of variation (MCV) for the 12 monthly factors was calculated by dividing their standard deviation by their mean (and multiplying by 100). The MCV, which shows the extent of monthly variation at each location, is useful to perform comparison between different locations and to decide whether a certain location can be classified as "recreational."
8. The monthly factors for all stations, along with other pertinent information, were tabulated for further analysis. Information presented in Table 2.2, below, is similar to that of Table 3-A-2 in the Traffic Monitoring Guide, page 3-A-3 (Reference 1). In this table, the 12 monthly factors for each location and their mean, MFAC, and the coefficient of variation, MCV, are shown. Missing values are indicated as (.).

TABLE 2.2 Monthly Factors

ATR	FC	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10	F11	F12	MFAC	MCV
01	1	1.432	1.342	1.137	0.983	0.952	0.877	0.960	0.738	0.929	0.938	1.013	1.136	1.036	18.089
02	1	1.239	1.092	0.992	0.969	0.965	0.922	0.921	0.907	0.999	0.997	1.050	1.061	1.009	8.753
03	1	1.422	1.299	1.234	.	0.990	0.895	0.829	0.897	0.943	1.045	1.086	1.166	1.073	16.714
04	1	1.391	1.254	0.986	0.933	0.940	0.914	0.772	.	.	.	.	.	1.027	19.447
05	1	1.475	1.333	1.015	0.893	0.955	0.915	0.849	0.846	0.919	0.917	1.066	1.247	1.036	19.049
06	1	1.133	1.033	0.901	0.880	.	.	.	.	.	.	.	.	0.099	10.413
07	2	1.211	1.165	1.006	0.980	0.921	0.921	0.937	0.926	0.953	0.965	1.037	1.191	1.017	10.281
08	2	1.513	1.383	.	0.904	0.973	0.928	0.864	0.859	0.957	0.935	1.048	1.186	1.050	19.863
09	2	1.367	.	1.065	1.032	0.940	0.946	0.936	0.942	0.947	0.962	1.043	1.169	1.032	12.300
10	2	1.354	1.258	1.026	0.986	0.911	0.921	0.928	0.866	0.912	0.906	1.061	1.118	1.020	14.406
11	2	1.270	.	.	.	.	0.950	1.041	0.957	1.000	1.009	1.043	0.949	1.028	9.579
12	6	1.031	0.952	.	1.026	1.017	0.985	1.095	0.946	1.003	0.995	1.011	.	1.006	3.999
13	6	1.217	1.075	0.984	0.975	0.958	0.925	0.948	0.956	0.965	0.984	1.036	1.057	1.009	7.639
14	6	.	1.167	1.015	1.011	0.960	0.952	0.994	0.967	0.982	0.968	1.152	.	1.017	7.273
15	6	1.250	1.145	0.968	0.911	0.939	1.161	0.841	0.861	0.939	0.998	1.043	1.204	1.022	12.892
16	6	1.234	1.217	0.915	0.906	0.956	0.946	0.996	0.967	0.960	0.984	1.021	0.999	1.008	10.122
17	6	1.149	1.090	0.967	0.968	0.935	0.945	0.951	0.949	0.977	1.010	1.077	1.041	1.005	6.585
18	6	1.254	1.106	0.953	1.026	0.980	0.998	0.946	0.950	0.974	0.906	1.074	1.094	1.022	9.039
19	7	1.278	1.159	0.988	0.940	0.923	0.941	0.942	0.972	0.968	0.957	0.960	1.101	1.010	10.422
20	7	1.210	1.130	0.841	0.893	.	.	.	.	0.925	0.891	1.006	1.068	0.995	12.289
21	7	1.651	1.533	1.052	0.993	0.892	0.869	0.746	0.813	0.872	0.864	1.241	1.473	1.083	27.594
22	7	.	.	.	1.162	1.049	0.956	0.947	0.929	0.973	0.911	1.038	1.087	1.006	7.844
23	7	1.092	1.080	0.931	0.976	0.950	0.968	1.006	0.930	0.947	0.944	1.183	1.119	1.011	8.126
24	7	1.266	1.175	1.012	0.976	0.903	0.916	0.928	0.924	0.941	0.965	1.113	1.150	1.022	11.398
25	7	1.214	1.123	0.915	0.954	0.964	0.930	0.945	0.939	0.950	0.951	1.033	1.142	1.005	9.477
26	11	1.183	1.158	1.241	1.133	0.991	0.926	0.897	0.872	0.939	0.943	1.006	1.102	1.032	11.571
27	11	1.184	1.293	.	.	0.962	0.916	0.920	0.905	0.965	0.962	1.049	1.115	1.027	12.092
30	11	1.435	1.442	1.147	0.937	0.962	0.838	0.803	0.873	0.958	0.967	1.025	1.166	1.046	19.481
31	12	1.311	1.167	0.891	0.971	0.807	0.938	0.997	0.934	0.957	0.984	1.102	1.304	1.030	14.744

33	14	1.345	1.110	0.961	.	0.966	0.936	0.942	0.943	0.954	0.966	1.028	1.171	1.029	12.021
34	14	1.015	0.981	0.908	0.923	0.906	0.952	1.187	1.080	1.015	0.992	1.038	1.027	1.002	7.636
35	14	1.353	1.108	0.997	0.980	0.984	0.954	0.950	0.968	1.008	1.029	1.010	1.001	1.028	10.262
36	14	1.148	1.086	0.972	0.968	0.926	0.915	0.954	0.923	0.950	0.992	1.113	1.158	1.009	8.641
37	16	1.221	1.089	1.006	0.976	0.965	0.971	0.995	0.882	0.945	1.003	1.086	1.097	1.020	8.424
38	17	1.155	1.167	0.962	0.952	0.948	0.926	0.965	1.005	0.981	0.999	1.026	1.043	1.011	7.356
39	1	1.212	1.128	1.024	1.004	0.970	0.912	0.899	0.907	0.927	0.913	0.981	1.187	1.005	10.643
40	16	1.130	1.012	0.920	1.005	0.932	0.930	0.991	1.038	1.023	0.994	1.066	1.061	1.008	5.907
41	16	1.160	0.970	0.960	0.972	0.933	0.909	0.951	0.942	0.971	1.034	1.088	1.144	1.003	8.030
42	11	1.195	1.205	0.953	0.934	0.985	.	0.813	0.851	0.922	0.929	1.037	1.232	1.005	13.745
43	7	1.168	1.074	0.948	1.003	0.951	0.958	0.989	0.970	0.984	0.992	1.011	1.109	1.013	6.492
44	6	1.004	0.970	0.955	0.942	0.915	1.271	0.996	0.943	0.957	0.969	1.034	1.069	1.002	9.062
45	7	1.162	1.113	0.962	0.962	0.938	0.953	1.007	0.852	0.973	0.971	1.132	1.211	1.020	10.163
46	7	1.381	1.721	1.308	0.924	0.912	0.883	0.813	0.858	0.953	0.896	1.144	1.733	1.127	28.278
47	1	1.266	1.181	0.907	0.811	1.080	0.876	0.766	0.814	1.340	1.122	1.011	1.080	1.021	17.668
48	6	1.616	1.147	0.972	0.972	0.953	0.943	0.978	0.935	0.954	0.940	1.108	0.984	1.042	17.724
49	6	1.273	1.024	1.001	1.098	1.127	1.104	0.975	0.899	1.040	0.931	0.963	0.941	1.031	9.780
50	1	1.268	1.214	1.050	0.950	0.985	0.963	0.938	0.893	0.989	.	.	.	1.028	11.810
51	7	1.167	1.168	1.079	0.948	0.926	0.921	0.935	0.935	0.959	0.968	1.127	1.199	1.028	10.277
53	1	1.450	1.570	1.098	0.980	0.922	0.898	0.822	0.828	0.909	0.924	0.983	1.185	1.047	21.990

Some of the ATR's have data missing due to equipment malfunction. For the purpose of statistical analysis, if this table is used as is, all ATR's that have even one month of missing data would not be included in the statistical data set. Therefore, it was decided to estimate the missing counts for the ATR's that have up to three months of missing data. Sites for which more than three months of data are missing were not included in the analysis. Table 2.3 shows a list of missing data.

TABLE 2.3 Missing Observations

ATR #	COUNTY	LOCATION	MONTH (S) MISSING
3	Kanawha	I-77, 2.1 MI N. OF CO 15	April
4	Wood	I-77 NB, 1.0 M S OF WV 14	August - December
6	Harrison	I-79, 0.2 M S OF CO 73/73	May - December
8	Nicholas	US 19 .06 M OF CO 19/45	March
9	Wood	US 50, 1.1 MI. E. OF I-77	February
11	Boone	US 119, 0.8 MI. S OF WV 3	February - May
12	Harrison	WV 131, 1.2 M OF US 50	March and December
14	Lewis	US 33, 0.4 MI. E OF CO 13	January and December
20	Grant	US 220 1.5 M S OF 220/4	May- August
22	Braxton	US 19 1.5 M OF CO 19/36	January - March
27	Kanawha	I-64, 2.0 MI W OF WV 622	March and April
33	Cabell	WV 10, 0.3 MI. S. OF I-64	April
42	Kanawha	I-64, E. OF KAN. CITY I/C	June
50	Berkeley	I-81, 1.6 MI. S. OF WV 45	October - December

In order to estimate the missing observations, stations that were deemed to be similar to the one with missing data were used. Similarity was determined based on the following criteria:

1. Functional classification code,
2. Variability in monthly factors as measured by the MCV,
3. Pattern of change in monthly factors, and

4. Geographic location.

Based on the above criteria, missing observations were estimated for stations with less than four months of missing data. Results are shown in Table 2.4, next page.

The estimated values of the missing observations were inserted into Table 2.2. The result is shown in Table 2.5, below. The values of MFAC and MCV were not re-calculated after estimating the missing data. The contents of this table were then uploaded to the IBM mainframe computer of the West Virginia Network for Educational Telecomputing (WVNET) for the purpose of performing cluster analysis, which will be discussed in Chapter 3.

TABLE 2.4 Estimation of Missing Observations

Station #	Month(s) Missing	Explanation
3	4	Used station #1. Average ratio for months 3 and 5 was used. (0.99/0.952 =1.04; 1.234/1.137 = 1.085); AVG. = (1.04 + 1.085)/2 = 1.063 Estimate for F4 = 1.063* 0.983 = 1.045
4	8-12	Too many missing observations; deleted from the data set
6	5-12	Too many missing observations; deleted from the data set
8	3	Used ATR #10. Calculations similar to station # 3
9	2	Used ATR #10. Calculations similar to station # 3
11	2-5	Too many missing observations; deleted from the data set
12	3 and 12	Could not satisfy the similarity condition within identical FC's. Used average of months 2 and 4 for month 3; and average of months 1 and 11 for month 12.
14	1 and 12	Used F1 and F12 values from station # 13
20	5-8	Too many missing observations; deleted from the data set
22	1-3	Used F1, F2, and F3 values from station #43
27	3 and 4	Used F3 and F4 values from station #26
33	4	Used F4 value from station #35
42	6	Used F6 = (F5 + F7) /2 = 0.899
50	10-12	Used F10, F11, and F12 values from station # 2

TABLE 2.5 Monthly Factors With Estimated Missing Observations

ATR	FC	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10	F11	F12	MFAC	MCV
01	1	1.432	1.342	1.137	0.983	0.952	0.877	0.960	0.738	0.929	0.938	1.013	1.136	1.036	18.089
02	1	1.239	1.092	0.992	0.969	0.965	0.922	0.921	0.907	0.999	0.997	1.050	1.061	1.009	8.753
03	1	1.422	1.299	1.234	1.045	0.990	0.895	0.829	0.897	0.943	1.045	1.086	1.166	1.073	16.714
04	1	DELETED													
05	1	1.475	1.333	1.015	0.893	0.955	0.915	0.849	0.846	0.919	0.917	1.066	1.247	1.036	19.049
06	1	DELETED													
07	2	1.211	1.165	1.006	0.980	0.921	0.921	0.937	0.926	0.953	0.965	1.037	1.191	1.017	10.281
08	2	1.513	1.383	1.034	0.904	0.973	0.928	0.864	0.859	0.957	0.935	1.048	1.186	1.050	19.863
09	2	1.367	1.288	1.065	1.032	0.940	0.946	0.936	0.942	0.947	0.962	1.043	1.169	1.032	12.300
10	2	1.354	1.258	1.026	0.986	0.911	0.921	0.928	0.866	0.912	0.906	1.061	1.118	1.020	14.406
11	2	DELETED													
12	6	1.031	0.952	0.989	1.026	1.017	0.985	1.095	0.946	1.003	0.995	1.011	1.021	1.006	3.999
13	6	1.217	1.075	0.984	0.975	0.958	0.925	0.948	0.956	0.965	0.984	1.036	1.057	1.009	7.639
14	6	1.217	1.167	1.015	1.011	0.960	0.952	0.994	0.967	0.982	0.968	1.152	1.057	1.017	7.273
15	6	1.250	1.145	0.968	0.911	0.939	1.161	0.841	0.861	0.939	0.998	1.043	1.204	1.022	12.892
16	6	1.234	1.217	0.915	0.906	0.956	0.946	0.996	0.967	0.960	0.984	1.021	0.999	1.008	10.122
17	6	1.149	1.090	0.967	0.968	0.935	0.945	0.951	0.949	0.977	1.010	1.077	1.041	1.005	6.585
18	6	1.254	1.106	0.953	1.026	0.980	0.998	0.946	0.950	0.974	0.906	1.074	1.094	1.022	9.039
19	7	1.278	1.159	0.988	0.940	0.923	0.941	0.942	0.972	0.968	0.957	0.960	1.101	1.010	10.422
20	7	DELETED													
21	7	1.651	1.533	1.052	0.993	0.892	0.869	0.746	0.813	0.872	0.864	1.241	1.473	1.083	27.594
22	7	1.168	1.074	0.984	1.162	1.049	0.956	0.947	0.929	0.973	0.911	1.038	1.087	1.006	7.844
23	7	1.092	1.080	0.931	0.976	0.950	0.968	1.006	0.930	0.947	0.944	1.183	1.119	1.011	8.126
24	7	1.266	1.175	1.012	0.976	0.903	0.916	0.928	0.924	0.941	0.965	1.113	1.150	1.022	11.398
25	7	1.214	1.123	0.915	0.954	0.964	0.930	0.945	0.939	0.950	0.951	1.033	1.142	1.005	9.477
26	11	1.183	1.158	1.241	1.133	0.991	0.926	0.897	0.872	0.939	0.943	1.006	1.102	1.032	11.571
27	11	1.184	1.293	1.241	1.133	0.962	0.916	0.920	0.905	0.965	0.962	1.049	1.115	1.027	12.092
30	11	1.435	1.442	1.147	0.937	0.962	0.838	0.803	0.873	0.958	0.967	1.025	1.166	1.046	19.481
31	12	1.311	1.167	0.891	0.971	0.807	0.938	0.997	0.934	0.957	0.984	1.102	1.304	1.030	14.744

33	14	1.345	1.110	0.961	0.953	0.966	0.936	0.942	0.943	0.954	0.966	1.028	1.171	1.029	12.021
34	14	1.015	0.981	0.908	0.923	0.906	0.952	1.187	1.080	1.015	0.992	1.038	1.027	1.002	7.636
35	14	1.353	1.108	0.997	0.980	0.984	0.954	0.950	0.968	1.008	1.029	1.010	1.001	1.028	10.262
36	14	1.148	1.086	0.972	0.968	0.926	0.915	0.954	0.923	0.950	0.992	1.113	1.158	1.009	8.641
37	16	1.221	1.089	1.006	0.976	0.965	0.971	0.995	0.882	0.945	1.003	1.086	1.097	1.020	8.424
38	17	1.155	1.167	0.962	0.952	0.948	0.926	0.965	1.005	0.981	0.999	1.026	1.043	1.011	7.356
39	1	1.212	1.128	1.024	1.004	0.970	0.912	0.899	0.907	0.927	0.913	0.981	1.187	1.005	10.643
40	16	1.130	1.012	0.920	1.005	0.932	0.930	0.991	1.038	1.023	0.994	1.066	1.061	1.008	5.907
41	16	1.160	0.970	0.960	0.972	0.933	0.909	0.951	0.942	0.971	1.034	1.088	1.144	1.003	8.030
42	11	1.195	1.205	0.953	0.934	0.985	0.899	0.813	0.851	0.922	0.929	1.037	1.232	1.005	13.745
43	7	1.168	1.074	0.948	1.003	0.951	0.958	0.989	0.970	0.984	0.992	1.011	1.109	1.013	6.492
44	6	1.004	0.970	0.955	0.942	0.915	1.271	0.996	0.943	0.957	0.969	1.034	1.069	1.002	9.062
45	7	1.162	1.113	0.962	0.962	0.938	0.953	1.007	0.852	0.973	0.971	1.132	1.211	1.020	10.163
46	7	1.381	1.721	1.308	0.924	0.912	0.883	0.813	0.858	0.953	0.896	1.144	1.733	1.127	28.278
47	1	1.266	1.181	0.907	0.811	1.080	0.876	0.766	0.814	1.340	1.122	1.011	1.080	1.021	17.668
48	6	1.616	1.147	0.972	0.972	0.953	0.943	0.978	0.935	0.954	0.940	1.108	0.984	1.042	17.724
49	6	1.273	1.024	1.001	1.098	1.127	1.104	0.975	0.899	1.040	0.931	0.963	0.941	1.031	9.780
50	1	1.268	1.214	1.050	0.950	0.985	0.963	0.938	0.893	0.989	0.997	1.050	1.061	1.028	11.810
51	7	1.167	1.168	1.079	0.948	0.926	0.921	0.935	0.935	0.959	0.968	1.127	1.199	1.028	10.277
53	1	1.450	1.570	1.098	0.980	0.922	0.898	0.822	0.828	0.909	0.924	0.983	1.185	1.047	21.990

CHAPTER THREE

3.1 INTRODUCTION

This chapter contains the work performed in the statistical analysis and formation of clusters based on 1995 traffic count data. The results of this analysis are used in the computation of seasonal factors. These steps can be followed when it is desired to define new clusters.

3.2 STATISTICAL ANALYSIS

As mentioned in Chapter 2, a high value of the monthly coefficient of variation (MCV) is an indication of high seasonality which is an attribute associated with "recreational" roads (Reference 1). MCV is calculated as the ratio of the standard deviation of the "monthly factors" to their mean (x100). The actual data, without the estimates of the missing observations, were used in these calculations. Data were then sorted based on the values of MCV to examine the patterns and decide on the recreational group. This sorted list is included in Appendix 1. Based on examination of this list, locations of ATR's number 21 and 46 were identified as recreational. Both locations are on rural major collectors and have a percent MCV greater than 25%.

3.3 CLUSTER ANALYSIS

In order to calculate "seasonal adjustment factors", it was necessary to group roads (or ATR's) with similar monthly factors together so that these factors can be calculated for the entire group. As prescribed in the Traffic Monitoring Guide (1), the monthly factors (ratios of AADT to MADT) were used to measure the similarity between ATR's and to group them into clusters. Since all the

variables used in the clustering process (monthly factors) are ratios close to the value of 1.0, there was no need to standardize the data (by subtracting from each variable its mean, and dividing the result by its standard deviation, so that each standardized variable would have a mean of zero and a standard deviation of 1, and all variables would have the same weight). Different clustering methods are available for the grouping process. As suggested in the Traffic Monitoring Guide (1), "Ward's Minimum Variance" method was used. In this method, the distance between two clusters is calculated as the sum of squares between the two clusters added up over all the variables. The method starts with all observations considered as individual clusters. At each iteration, the within-cluster sum of squares is minimized over all partitions obtainable by merging two clusters from the previous iteration. The merging process continues until all observations are merged into one cluster. Ward's method tends to join clusters that have a small number of observations and, hence, tends to produce clusters with roughly similar number of observations. More details about Ward's method may be found is SAS User's Guide (12) or in Ward's article (13).

A SAS program was developed to perform the cluster analysis and is listed in Appendix 2. The results obtained are given in Appendix 3. From these results, the ATR's may be tentatively grouped in 7 clusters as shown in Table 3.1. This table shows how groups were formed in the clustering analysis. Entries in the table show the number of the group formed, followed by the number of ATR's in the group. The group number corresponds to the order followed in the clustering program. For example, in the last step, group number 1 was formed with all 45 ATR's, and consists of groups number 2, and 3, and so on. The last entries in each column show the cluster number, and the numbers of the ATR's included in the cluster.

TABLE 3.1 Tentative Scheme for ATR Clustering

<table>
<tr><td colspan="8">GP 1 (45)</td></tr>
<tr><td colspan="2">GP 2 (11)</td><td colspan="6">GP 3 (34)</td></tr>
<tr><td>GP 8 (2)</td><td>GP 7 (9)</td><td colspan="5">GP 4 (31)</td><td>GP 12 (3)</td></tr>
<tr><td>CL 1</td><td>CL 2</td><td>CL 3</td><td colspan="4">GP 5 (30)</td><td>CL 7</td></tr>
<tr><td rowspan="4">21, 46</td><td rowspan="4">1, 3, 5, 8, 9, 10, 30, 48, 53</td><td rowspan="4">47</td><td colspan="3">GP 6 (28)</td><td>GP 34 (2)</td><td rowspan="4">12, 34, 44</td></tr>
<tr><td>GP 13 (7)</td><td colspan="2">GP 9 (21)</td><td>CL 6</td></tr>
<tr><td>CL 4</td><td colspan="2">CL 5</td><td rowspan="2">26, 27</td></tr>
<tr><td>7, 15, 24, 31, 39, 42, 51</td><td colspan="2">2, 13, 14, 16, 17, 18, 19, 22, 23, 25, 33, 35, 36, 37, 38, 40, 41, 43, 45</td></tr>
</table>

One major problem with the above clustering scheme is that in a number of cases roads that have the same functional classification code are grouped in different clusters. This would create a problem when the seasonal factors calculated for a cluster are applied to a new road. It is desirable to group all ATR's of roads of the same functional classification code together, so that the factors calculated for the cluster may be applied to any new road that matches any of the functional classification codes of the ATR's in the cluster. In this case, one may use his best judgement to move some of the ATR's shown in Table 3.1 around such that ATR's with the same functional classification number would belong to the same cluster. This approach was followed in the example given in the TMG (1). Following this approach, the ATR's were grouped in five clusters as shown in Table 3.2.

TABLE 3.2 Adjusted Tentative Scheme for ATR Clustering

CLUSTER		STATION NUMBER	FUNCT. CLASS
1. RURAL			
Principal Arterial -	Interstate	1, 2, 3, 5, 39, 47, 50, 53	1
Principal Arterial -	Other	7, 8, 9, 10	2
2. RURAL			
Minor Arterial		12, 13, 14, 15, 16, 17, 18, 44	6
		48, 49	6
Major Collector		19, 22, 23, 24, 25, 43, 45, 51	7
3. URBAN			
Principal Arterial -	Interstate	26, 27, 30, 42	11
Principal Arterial -	Other Freeways or Expressways	31	12
4. URBAN			
Principal Arterial -	Other	33, 34, 35, 36	14
Minor Arterial		37, 40, 41	16
Collector		38	17
5. RECREATIONAL		21, 46	7

An alternative approach would be to use the functional classification codes as part of the clustering procedure. To follow this approach a new variable, "functional code value" was introduced to assign a value to each code as shown in Table 3.3.

TABLE 3.3 Values Assigned to Functional Classification Codes

Code	Value	Functional Classification
01	10	Rural - Principal Arterial - Interstate
02	20	Rural - Principal Arterial - Other
06	30	Rural - Minor Arterial
07	40	Rural - Major Collector
08	50	Rural - Minor Collector
09	60	Rural - Local System
11	110	Urban - Principal Arterial - Interstate
12	120	Urban - Principal Arterial - Other Freeways or Expressways
14	130	Urban - Principal Arterial - Other
16	140	Urban - Minor Arterial - Other
17	150	Urban - Collector
19	160	Urban - Local System
---	500	Recreational

With the inclusion of the new variable, the functional classification code value will carry more weight in the clustering analysis than any of the monthly factors. In addition, ATR's for rural roads will tend to be clustered with those of other rural roads with similar or close functional code values. The same is true for ATR's of urban roads. Recreational roads are practically forced to be grouped together. As an example, rural-principal-arterial-interstate roads will have a better chance to be grouped with rural-principal-arterial-other roads than with rural-minor-collector roads or with any urban or recreational road.

A SAS program was developed to perform the new cluster analysis and is listed in Appendix 4. The results obtained are given in Appendix 5. From these results, the ATR's may be tentatively grouped in 5 clusters as shown in Table 3.4. Three of these clusters may be divided into smaller ones to form up to a total of eight clusters as shown in the table.

TABLE 3.4 Modified Tentative Scheme for ATR Clustering

<table>
<tr><td colspan="8">GP 1 (45)</td></tr>
<tr><td colspan="7">GP 2 (43)</td><td>GP 14 (2)</td></tr>
<tr><td colspan="5">GP 3 (30)</td><td colspan="2">GP 4 (13)</td><td rowspan="4">CL 5</td></tr>
<tr><td colspan="2">GP 7 (12)</td><td colspan="3">GP 6 (18)</td><td>GP 16 (4)</td><td colspan="2">GP 5 (9)</td></tr>
<tr><td colspan="2">CL 1</td><td colspan="3">CL 2</td><td>CL 3</td><td colspan="2">CL 4</td></tr>
<tr><td>CL 1A</td><td>CL 1B</td><td>CL 2A</td><td colspan="2">CL 2B</td><td>CL 3</td><td>CL 4A</td><td>CL 4B</td></tr>
<tr><td>1, 2, 3, 5, 39, 47, 50, 53</td><td>7, 8, 9, 10</td><td>12, 13, 14, 15, 16, 17, 18, 44, 48, 49</td><td colspan="2">19, 22, 23, 24, 25, 43, 45, 51</td><td>26, 27, 30, 42</td><td>31, 33, 34, 35, 36</td><td>37, 38, 40, 41</td><td>21, 46</td></tr>
</table>

Entries in this table may be interpreted similar to those of Table 3.1. A careful examination of the entries in this table shows that the problem encountered with the first clustering scheme does not exist here. In other words, ATR's of roads that have the same functional classification codes are grouped in the same cluster. The resulting modified clusters are presented in Table 3.5.

TABLE 3.5 Modified Clusters

GROUP		STATION NUMBER	FUNC. CLASS
1- RURAL			
Principal Arterial -	Interstate	1, 2, 3, 5, 39, 47, 50, 53	1
Principal Arterial -	Other	7, 8, 9, 10	2
2- RURAL			
Minor Arterial		12, 13, 14, 15, 16, 17, 18, 44	6
		48, 49	6
Major Collector		19, 22, 23, 24, 25, 43, 45, 51	7
3- URBAN			
Principal Arterial -	Interstate	26, 27, 30, 42	11
4- URBAN			
Principal Arterial -	Other Freeways or Expressways	31	12
Principal Arterial -	Other	33, 34, 35, 36	14
Minor Arterial		37, 40, 41	16
Collector		38	17
5- RECREATIONAL		21, 46	7

A comparison between Tables 3.2 and 3.5 shows that the results obtained in both cases are similar with the exception of ATR # 31 (Urban Principal Arterial - Other Freeways or Expressways) which moved from a cluster with "Urban Arterial - Interstate" to a cluster with the other urban roads. The results shown in Table 3.5 are the ones that were used in the calculation of the "Seasonal Adjustment Factors".

3.4 CONSIDERATION OF TRAFFIC VOLUMES

An examination of traffic volumes (AADT) for the different classes of road (as defined by the functional classification codes) showed relatively uniform volumes for the roads within each of the classes, except for the "rural principal arterial interstate" roads where the volumes varied widely. Roads in this group were divided into two subgroups: Those with AADT less than 20,000 and those with AADT greater than 20,000. A cluster analysis was then performed while using the following variables to measure the similarity between ATR's: Monthly factors, Functional Classification Values, and AADT. The results obtained are given in Table 3.6. These results are essentially the same as those given in Table 3.5.

TABLE 3.6 Cluster Results Obtained with Traffic Volume Consideration

GROUP	STATION NUMBER	FUNC. CLASS
RURAL		
Principal Arterial - Interstate (AADT>20K)	2, 3, 39, 50	1
Principal Arterial - Interstate (AADT < 20K)	1, 5, 47, 53	1
Principal Arterial - Other	7, 8, 9, 10	2
RURAL		
Minor Arterial	12, 13, 14, 15, 16	6
	17, 18, 44, 48, 49	6
Major Collector	19, 22, 23, 24, 25	7
	43, 45, 51	7
URBAN		
Principal Arterial - Interstate	26, 27, 30, 42	11
URBAN		
Principal Arterial - Other Freeways or Expressways	31	12
Principal Arterial - Other	33, 34, 35, 36	14
Minor Arterial	37, 40, 41	16
Collector	38	17
RECREATIONAL	21, 46	7

CHAPTER FOUR

4.1 INTRODUCTION

This chapter contains details of steps, as listed below, that can be followed on an annual basis to compute seasonal factors based on the current year data.

1. Data Importation: A CSV (Comma-Separated-Value) file containing traffic counts recorded at each of the permanent ATR's is imported from the WVDOH-MIS into an Excel worksheet.
2. Factor Calculation for Individual Sites: Using the traffic counts, monthly and day-of-week factors are computed for each site. A file that contains the data needed for the cluster analysis is generated.
3. Cluster Analysis: Cluster analysis is then performed after which each traffic counter is assigned a cluster number.
4. Factor Calculation for Clusters: All the daily and monthly factors are computed for each cluster using all the data available for the counters in that cluster.

If the number of ATR's and the nature of the data are changed significantly, it is recommended to perform a new cluster analysis. Otherwise, the cluster analysis step may be skipped.

Each of the above steps is described in sections 4.2 through 4.5. These steps are combined in an easy to follow procedure in section 4.6.

4.2 Data Importation

In order to facilitate the computation of seasonal factors in the future, a computer macro was

written to read the data from the Traffic Management Information System at WVDOH into an MS Excel worksheet. This macro, coded using Visual Basic in an Excel environment, will also be used later to compute the monthly and day-of-the-week factors for each ATR.

The data obtained from the traffic counters must be stored in an ASCII format in a '.CSV' (Comma Separated Value) file. This file contains the traffic count at each counter for each day of the year. Weekdays are coded as follows:

Sunday	-	1
Monday	-	2
Tuesday	-	3
Wednesday	-	4
Thursday	-	5
Friday	-	6
Saturday	-	7

The first two rows of the file contain general information, as shown in Appendix 6. These two rows show the current year, and the total number of stations. Then, for each site, the file contains a block of 50 rows and 27 columns. The first row shows the station number and description of its functional classification. The second row is left blank. The third row shows the PATR number, its location, and spaces for manual entry of the cluster number and the functional classification code. The fourth row is left blank. Row five contains headings for data that will follow. The next 31 rows contain the data for each day of the month. Each data row contains the following columns:

Column Number	Description
1	Sequential day of the month (1 through 31)

2	Blank
3	Weekday Code (1 through 7) corresponding to that day in January
4	Traffic counts taken on that day in January
5 - 26	The pattern for columns 3 and 4 is repeated for the next 11 months
27	Blank

To run the macro, a file called *'factors.xls'* is opened in MS Excel. The initial setup of the worksheet is done using the steps described below. Once the worksheet is setup for data import, the '.CSV' file is opened and its contents are read into the worksheet as described below. There are various short cut keys in the macro which perform certain tasks before reading in the data. Once the relevant data for all the counters are read in, the macro is ready to compute the monthly and the daily factors for each counter.

4.3 Factor Calculation for Individual Sites

During the course of a month, there may be days when the counter does not record any data. The total annual traffic is the sum of entries for each month of that year. The *Annual Average Daily Traffic* (AADT) is the ratio of the total annual traffic to the total number of days in the year for which data are obtained. The *Monthly Average Daily Traffic* (MADT) is the ratio of the total monthly traffic to the number of non-zero entries for that month. The monthly factor for each month of the year is then computed as:

Monthly Factor = AADT / MADT

The factor for day of the week within a month is computed next. For example, the Sunday factor for the month of January would be:

$$\frac{\text{MADT}}{\text{(Total traffic on all Sundays of the month / Number of Sundays with data in January)}}$$

These calculations are done for all the counters for each day of the week for every month of the year.

At this stage, an additional Excel worksheet is generated which contains, for each ATR, its number, functional classification code, and the corresponding twelve monthly factors. The contents of this file must be written into an ASCII file that can be used by any statistical package capable of performing cluster analysis.

4.4 Cluster Analysis

As mentioned earlier, this step is performed only when new clusters need to be formed. Details of this analysis are given in Chapter three.

4.5 Factor Calculation for Clusters

After the completion of the cluster analysis, each site is assigned a particular cluster number which is entered at a specific cell in the spreadsheet. Certain sites may not be assigned to any cluster due to lack of sufficient data for clustering. These sites are grouped together in an additional cluster at the end. The macro calculates the day-of-the-week factor and the MADT for each cluster using the methods explained earlier. A listing of all portions of the Excel macro is shown in Appendix

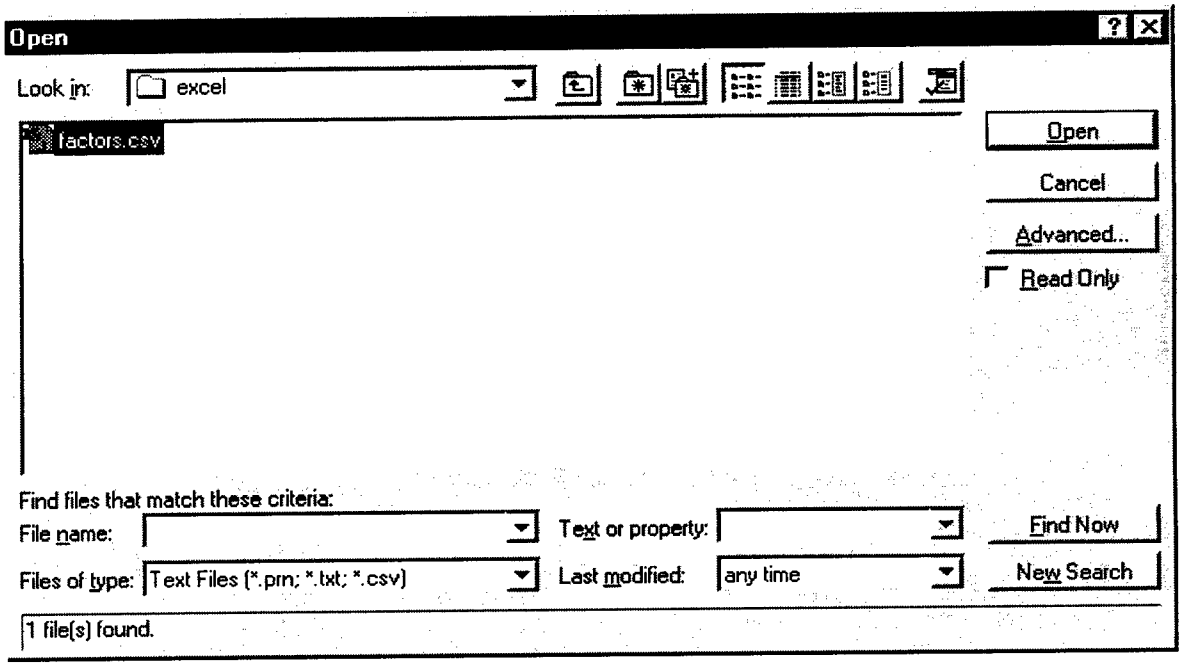
7 and is included in a disk file attached to this report.

4.6 Step by Step Procedure to Read in Data and Compute Factors

As data become available on a yearly basis, the following steps must be taken to compute new seasonal factors. Please note that the CSV file must be generated by the WVDOH MIS . The format and specification of this file is programmed into the MIS to ensure compatibility.

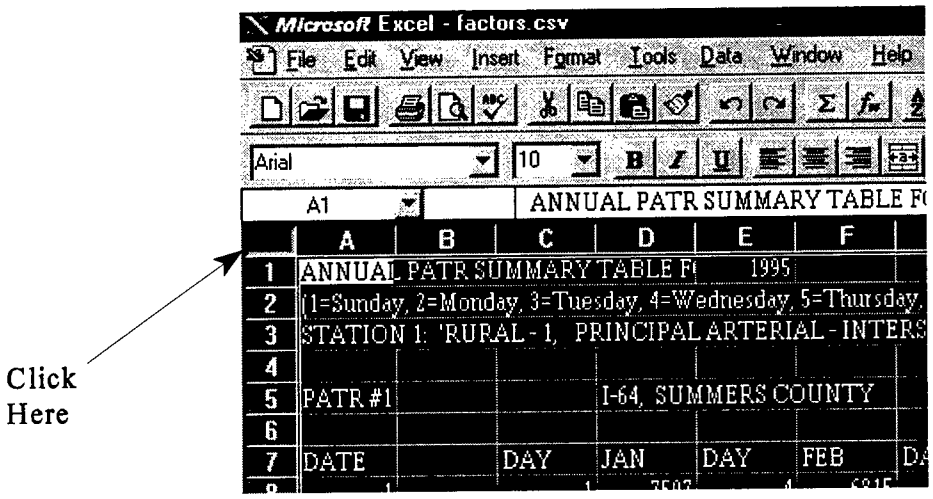
Step 1: Importing the CSV File into MS-Excel

Once MS Excel is opened, go to the 'File' menu and select 'Open' option. An 'Open' dialog box will show up on the screen. Locate the 'CSV' input file and select it. Then, click on the 'Open' button. The CSV file is now opened in MS Excel. The user will see the screen shown below.



Step 2: Copying File to the Clipboard

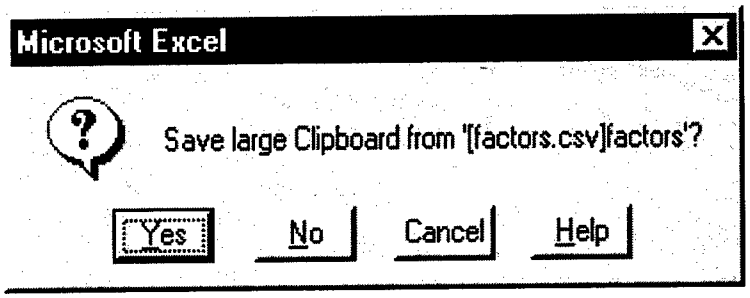
Select the whole file by clicking on the sheet as shown below :



Then go to the 'Edit' menu and select 'Copy' option.

Step 3: Close the CSV File

Go to the 'File' menu and select the 'Close' option. MS Excel will display the following message:



Select the 'Yes' option.

Step 4: Open FACTORS.XLS

Go to the File menu and select the 'Open' option. Locate and select 'factors.xls' and open it, similar to the way 'factors.csv' was opened.

Step 5: Delete Present Contents of Raw Data in FACTORS.XLS

Hit 'Ctrl+l' to delete the contents of the worksheet.

Step 6: Generate New 'Raw Data'

Go to the 'Edit' menu and select the paste option. Now, the contents of 'factors.csv' should exist in the 'Raw-Data' worksheet. Go to the 'File' menu and select the 'Save' option.

Step 7: Compute the Monthly and Daily Factors For Each Station

Select DOH Macro 3 from the tools menu or hit 'Ctrl+c'. This will compute the factors for all the traffic counters.

Step 8: Cluster Analysis

As mentioned earlier, the cluster analysis may be skipped. However, if a new cluster analysis is desired, the user must run DOH Macro 5 from the tools menu. This will generate a new worksheet entitled 'SAS_UPLOAD'. Then, click on this new sheet to make it the "current"

worksheet. Next, go to 'File' menu and save this sheet as a .CSV file which can be used as the input to the SAS program. Once the cluster analysis is completed, the cluster numbers corresponding to each station must be manually entered into the 'Raw Data' worksheet.

The user must always examine Cell (K2) of the 'Raw Data' worksheet and make sure that it contains the correct number of clusters. The user will also need to make sure that the cluster number assigned to each site is entered accurately in the corresponding cell along column 'I'.

Step 9 : Compute the Monthly and Daily Factors For Each Cluster

Hit "Ctrl+c" on the keyboard or select Macro-4 from the tools menu. This will compute the factors for all clusters. The factors for all clusters are printed on the "Cluster-Sheet" and "Cluster-Sheet-2" worksheets. Save the workbook by going to 'File' menu and selecting the 'Save' option. Then, go to 'File' menu again and select 'Exit' option to quit.

Steps outlined in the above were followed for the 1995 data which were available at the time this report was written. Results are shown in Appendix 8.

CHAPTER FIVE

5.1 CONCLUSIONS

West Virginia Division of Highways collects traffic counts at selected sites throughout the state. Some of these counts are continuously taken at permanent sites and some are from short duration counts. Clearly, it is extremely important for the WVDOH to organize the massive data collected into a usable format and have the capability to generate 'information' that can be used by planners and decision makers. The current project, along with another ongoing project on MIS development, will enable the WVDOH to do just that. This effort by the WVDOH enables them to not only meet the regulatory mandates, but be way ahead of the curve in the use of information in sound decision making.

In this research, data collected at permanent sites were statistically analyzed to reveal similarities in traffic patterns and to 'cluster' similar counters in smaller groups. These clusters can be further analyzed to point out more details and reveal the nature of their 'seasonality patterns.' The range of options available in terms of the variety and details of statistical analysis is vast. However, practicality and the potential for usefulness of information generated must always guide our efforts in data manipulation and analysis. Also, keep in mind that in spite of mathematical rigor associated with the statistical analysis performed, personal judgement in some instances must be used to make sure that results are reasonable and useful.

Results of the clustering used to compute the seasonal factors are shown in Appendix 8. This appendix must be consulted to convert the short term count taken at a certain location to the AADT for that location. Of course, one must first establish from the functional classification code, traffic

volume, and location which cluster fits this new location best. Then, the short count is multiplied by the appropriate monthly and day-of-the-week factors. Alternatively, the short count may be multiplied directly by the day-of-the-week factor for the corresponding month in that cluster.

In conclusion, it must be noted that the accuracy and precision of the conclusions made from any statistical analysis must be ascertained with future data collection and analysis. The counters clustered together based on 1995 data may not hold together in the future. It is recommended to perform the cluster analysis when the number of ATR's or the nature of the data are changed significantly to find out how clusters may have changed and what the final grouping of counters may look like. This recommendation becomes especially more important if several counters are taken out of service, or functional classification code at some sites are altered, or a number of new permanent counters are added to the system.

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APPENDIX 1

ATR Data Sorted Based on MCV to Identify Recreational Sites

ATR	FC	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10	F11	F12	MFAC	MCV
12	6	1.031	0.952	.	1.026	1.017	0.985	1.095	0.946	1.003	0.995	1.011	.	1.006	3.999
40	16	1.130	1.012	0.920	1.005	0.932	0.930	0.991	1.038	1.023	0.994	1.066	1.061	1.008	5.907
43	7	1.168	1.074	0.948	1.003	0.951	0.958	0.989	0.970	0.984	0.992	1.011	1.109	1.013	6.492
17	6	1.149	1.090	0.967	0.968	0.935	0.945	0.951	0.949	0.977	1.010	1.077	1.041	1.005	6.585
14	6	.	1.167	1.015	1.011	0.960	0.952	0.994	0.967	0.982	0.968	1.152	.	1.017	7.273
38	17	1.155	1.167	0.962	0.952	0.948	0.926	0.965	1.005	0.981	0.999	1.026	1.043	1.011	7.356
34	14	1.015	0.981	0.908	0.923	0.906	0.952	1.187	1.080	1.015	0.992	1.038	1.027	1.002	7.636
13	6	1.217	1.075	0.984	0.975	0.958	0.925	0.948	0.956	0.965	0.984	1.036	1.057	1.009	7.639
22	7	.	.	.	1.162	1.049	0.956	0.947	0.929	0.973	0.911	1.038	1.087	1.006	7.844
41	16	1.160	0.970	0.960	0.972	0.933	0.909	0.951	0.942	0.971	1.034	1.088	1.144	1.003	8.030
23	7	1.092	1.080	0.931	0.976	0.950	0.968	1.006	0.930	0.947	0.944	1.183	1.119	1.011	8.126
37	16	1.221	1.089	1.006	0.976	0.965	0.971	0.995	0.882	0.945	1.003	1.086	1.097	1.020	8.424
36	14	1.148	1.086	0.972	0.968	0.926	0.915	0.954	0.923	0.950	0.992	1.113	1.158	1.009	8.641
2	1	1.239	1.092	0.992	0.969	0.965	0.922	0.921	0.907	0.999	0.997	1.050	1.061	1.009	8.753
18	6	1.254	1.106	0.953	1.026	0.980	0.998	0.946	0.950	0.974	0.906	1.074	1.094	1.022	9.039
44	6	1.004	0.970	0.955	0.942	0.915	1.271	0.996	0.943	0.957	0.969	1.034	1.069	1.002	9.062
25	7	1.214	1.123	0.915	0.954	0.964	0.930	0.945	0.939	0.950	0.951	1.033	1.142	1.005	9.477
11	2	1.270	.	.	.	.	0.950	1.041	0.957	1.000	1.009	1.043	0.949	1.028	9.579
49	6	1.273	1.024	1.001	1.098	1.127	1.104	0.975	0.899	1.040	0.931	0.963	0.941	1.031	9.780
16	6	1.234	1.217	0.915	0.906	0.956	0.946	0.996	0.967	0.960	0.984	1.021	0.999	1.008	10.12
45	7	1.162	1.113	0.962	0.962	0.938	0.953	1.007	0.852	0.973	0.971	1.132	1.211	1.020	10.16
35	14	1.353	1.108	0.997	0.980	0.984	0.954	0.950	0.968	1.008	1.029	1.010	1.001	1.028	10.26
51	7	1.167	1.168	1.079	0.948	0.926	0.921	0.935	0.935	0.959	0.968	1.127	1.199	1.028	10.27
7	2	1.211	1.165	1.006	0.980	0.921	0.921	0.937	0.926	0.953	0.965	1.037	1.191	1.017	10.28
6	1	1.133	1.033	0.901	0.880	.	.	.	.	.	.	.	.	0.099	10.41
19	7	1.278	1.159	0.988	0.940	0.923	0.941	0.942	0.972	0.968	0.957	0.960	1.101	1.010	10.42
39	1	1.212	1.128	1.024	1.004	0.970	0.912	0.899	0.907	0.927	0.913	0.981	1.187	1.005	10.64
24	7	1.266	1.175	1.012	0.976	0.903	0.916	0.928	0.924	0.941	0.965	1.113	1.150	1.022	11.39
26	11	1.183	1.158	1.241	1.133	0.991	0.926	0.897	0.872	0.939	0.943	1.006	1.102	1.032	11.57
50	1	1.268	1.214	1.050	0.950	0.985	0.963	0.938	0.893	0.989	.	.	.	1.028	11.81
33	14	1.345	1.110	0.961	.	0.966	0.936	0.942	0.943	0.954	0.966	1.028	1.171	1.029	12.02
27	11	1.184	1.293	.	.	0.962	0.916	0.920	0.905	0.965	0.962	1.049	1.115	1.027	12.09
20	7	1.210	1.130	0.841	0.893	.	.	.	.	0.925	0.891	1.006	1.068	0.995	12.28
9	2	1.367	.	1.065	1.032	0.940	0.946	0.936	0.942	0.947	0.962	1.043	1.169	1.032	12.30
15	6	1.250	1.145	0.968	0.911	0.939	1.161	0.841	0.861	0.939	0.998	1.043	1.204	1.022	12.89
42	11	1.195	1.205	0.953	0.934	0.985	.	0.813	0.851	0.922	0.929	1.037	1.232	1.005	13.74
10	2	1.354	1.258	1.026	0.986	0.911	0.921	0.928	0.866	0.912	0.906	1.061	1.118	1.020	14.40
31	12	1.311	1.167	0.891	0.971	0.807	0.938	0.997	0.934	0.957	0.984	1.102	1.304	1.030	14.74
3	1	1.422	1.299	1.234	.	0.990	0.895	0.829	0.897	0.943	1.045	1.086	1.166	1.073	16.71
47	1	1.266	1.181	0.907	0.811	1.080	0.876	0.766	0.814	1.340	1.122	1.011	1.080	1.021	17.66

48	6	1.616	1.147	0.972	0.972	0.953	0.943	0.978	0.935	0.954	0.940	1.108	0.984	1.042	17.72
1	1	1.432	1.342	1.137	0.983	0.952	0.877	0.960	0.738	0.929	0.938	1.013	1.136	1.036	18.08
5	1	1.475	1.333	1.015	0.893	0.955	0.915	0.849	0.846	0.919	0.917	1.066	1.247	1.036	19.04
4	1	1.391	1.254	0.986	0.933	0.940	0.914	0.772	.	.	.	.	.	1.027	19.44
30	11	1.435	1.442	1.147	0.937	0.962	0.838	0.803	0.873	0.958	0.967	1.025	1.166	1.046	19.48
8	2	1.513	1.383	.	0.904	0.973	0.928	0.864	0.859	0.957	0.935	1.048	1.186	1.050	19.86
53	1	1.450	1.570	1.098	0.980	0.922	0.898	0.822	0.828	0.909	0.924	0.983	1.185	1.047	21.99
21	7	1.651	1.533	1.052	0.993	0.892	0.869	0.746	0.813	0.872	0.864	1.241	1.473	1.083	27.59
46	7	1.381	1.721	1.308	0.924	0.912	0.883	0.813	0.858	0.953	0.896	1.144	1.733	1.127	28.27

APPENDIX 2

SAS Program for the First Cluster

```
CMS FILEDEF SEASON DISK LEGG DAT A;
OPTIONS LINESIZE = 80;
OPTIONS  PAGESIZE=65;
DATA WVDOH;
INFILE SEASON;
INPUT ATRNO FC  F1-F12;
IF ATRNO = 4 THEN DELETE;
IF ATRNO = 6 THEN DELETE;
IF ATRNO = 11 THEN DELETE;
IF ATRNO = 20 THEN DELETE;
RUN;
PROC CLUSTER METHOD = WARD;
VAR F1-F12;
ID ATRNO;
RUN;
```

APPENDIX 3

Results of the First Cluster Analysis

Ward's Minimum Variance Cluster Analysis

Eigenvalues of the Covariance Matrix

	Eigenvalue	Difference	Proportion	Cumulative
1	0.058569	0.045878	0.566964	0.56696
2	0.012691	0.003905	0.122848	0.68981
3	0.008786	0.001856	0.085048	0.77486
4	0.006930	0.002294	0.067086	0.84195
5	0.004636	0.001209	0.044878	0.88682
6	0.003427	0.001115	0.033179	0.92000
7	0.002313	0.000520	0.022389	0.94239
8	0.001793	0.000133	0.017358	0.95975
9	0.001660	0.000205	0.016072	0.97582
10	0.001455	0.000747	0.014089	0.98991
11	0.000709	0.000375	0.006860	0.99677
12	0.000334	.	0.003231	1.00000

Root-Mean-Square Total-Sample Standard Deviation = 0.092782
Root-Mean-Square Distance Between Observations = 0.454538

Ward's Minimum Variance Cluster Analysis

Number of Clusters	-----Clusters Joined------		Frequency of New Cluster	Semipartial R-Squared	R-Squared	Tie
44	2	13	2	0.000616	0.999384	
43	5	8	2	0.001224	0.998160	
42	7	24	2	0.001233	0.996927	
41	17	38	2	0.001414	0.995513	
40	36	45	2	0.001610	0.993903	
39	25	43	2	0.001789	0.992114	
38	CL44	37	3	0.001997	0.990116	
37	9	10	2	0.002123	0.987994	
36	CL42	51	3	0.002185	0.985809	
35	19	33	2	0.002234	0.983576	
34	26	27	2	0.002622	0.980953	
33	18	CL39	3	0.002737	0.978216	

32	23	CL40	3	0.002826	0.975390
31	40	41	2	0.003112	0.972278
30	14	50	2	0.003347	0.968931
29	CL38	CL33	6	0.003351	0.965580
28	39	42	2	0.003578	0.962002
27	16	CL41	3	0.003718	0.958284
26	30	53	2	0.003830	0.954454
25	CL35	35	3	0.004587	0.949867
24	CL30	CL27	5	0.005692	0.944175
23	12	34	2	0.006492	0.937683
22	CL36	CL28	5	0.006575	0.931108
21	CL29	CL24	11	0.006867	0.924241
20	1	CL37	3	0.007737	0.916504
19	CL32	CL31	5	0.008330	0.908175
18	22	49	2	0.009013	0.899162
17	CL21	CL25	14	0.009020	0.890142
16	CL20	3	4	0.010210	0.879932
15	CL43	CL26	4	0.010546	0.869386
14	CL22	31	6	0.012768	0.856618
13	CL14	15	7	0.014295	0.842323
12	CL23	44	3	0.018552	0.823771
11	CL16	CL15	8	0.018725	0.805046
10	CL17	CL19	19	0.021883	0.783163
9	CL10	CL18	21	0.027888	0.755275
8	21	46	2	0.029728	0.725547
7	CL11	48	9	0.030397	0.695150
6	CL9	CL13	28	0.033885	0.661265
5	CL6	CL34	30	0.046867	0.614399
4	CL5	47	31	0.058976	0.555423
3	CL4	CL12	34	0.069382	0.486041
2	CL7	CL8	11	0.123254	0.362787
1	CL2	CL3	45	0.362787	0.000000

APPENDIX 4

SAS Program to Perform the Second Cluster Analysis

```
CMS FILEDEF SEASON DISK LEGG DAT A;
OPTIONS LINESIZE = 80;
OPTIONS  PAGESIZE=65;
DATA WVDOH;
INFILE SEASON;
INPUT ATRNO FC F1-F12;
IF ATRNO = 4 THEN DELETE;
IF ATRNO = 6 THEN DELETE;
IF ATRNO = 11 THEN DELETE;
IF ATRNO = 20 THEN DELETE;
RUN;
IF FC= 1 THEN FC1 = 10;
IF FC= 2 THEN FC1 = 20;
IF FC= 3 THEN FC1 = 30;
IF FC= 4 THEN FC1 = 40;
IF FC= 5 THEN FC1 = 50;
IF FC= 6 THEN FC1 = 60;
IF FC= 7 THEN FC1 = 70;
IF FC= 8 THEN FC1 = 80;
IF FC= 9 THEN FC1 = 90;
IF FC= 11 THEN FC1 = 110;
IF FC= 12 THEN FC1 = 120;
IF FC= 14 THEN FC1 = 130;
IF FC= 16 THEN FC1 = 140;
IF FC= 17 THEN FC1 = 150;
IF FC= 19 THEN FC1 = 160;
IF ATRNO = 21 OR ATRNO = 46 THEN FC1 = 500;
RUN;
PROC SORT;
BY FC;
RUN;
PROC CLUSTER METHOD = WARD;
VAR F1-F12 FC1;
ID ATRNO;
RUN;
```

APPENDIX 5

Results of the Second Cluster Analysis

Ward's Minimum Variance Cluster Analysis

Eigenvalues of the Covariance Matrix

	Eigenvalue	Difference	Proportion	Cumulative
1	10783.1	10783.1	0.999992	0.99999
2	0.0	0.0	0.000004	1.00000
3	0.0	0.0	0.000001	1.00000
4	0.0	0.0	0.000001	1.00000
5	0.0	0.0	0.000001	1.00000
6	0.0	0.0	0.000000	1.00000
7	0.0	0.0	0.000000	1.00000
8	0.0	0.0	0.000000	1.00000
9	0.0	0.0	0.000000	1.00000
10	0.0	0.0	0.000000	1.00000
11	0.0	0.0	0.000000	1.00000
12	0.0	0.0	0.000000	1.00000
13	0.0	.	0.000000	1.00000

Root-Mean-Square Total-Sample Standard Deviation = 28.80069
Root-Mean-Square Distance Between Observations = 146.8553

Ward's Minimum Variance Cluster Analysis

Number of Clusters	------Clusters Joined------		Frequency of New Cluster	Semipartial R-Squared	R-Squared	Tie
44	13	17	2	0.000000	1.000000	
43	25	43	2	0.000000	1.000000	
42	24	51	2	0.000000	1.000000	T
41	9	10	2	0.000000	1.000000	
40	2	50	2	0.000000	1.000000	
39	26	27	2	0.000000	1.000000	
38	14	18	2	0.000000	1.000000	T
37	23	45	2	0.000000	1.000000	
36	40	41	2	0.000000	1.000000	

35	19	CL43	3	0.000000	1.000000	
34	CL44	CL38	4	0.000000	1.000000	
33	33	35	2	0.000000	1.000000	
32	CL40	39	3	0.000000	1.000000	T
31	37	CL36	3	0.000000	1.000000	
30	7	CL41	3	0.000000	1.000000	T
29	CL34	16	5	0.000000	0.999999	
28	1	5	2	0.000000	0.999999	
27	CL37	CL42	4	0.000000	0.999999	
26	CL33	36	3	0.000000	0.999999	
25	CL35	22	4	0.000000	0.999999	T
24	CL28	53	3	0.000000	0.999999	
23	12	44	2	0.000000	0.999999	T
22	CL24	3	4	0.000000	0.999999	
21	CL25	CL27	8	0.000000	0.999999	T
20	CL30	8	4	0.000000	0.999999	
19	30	42	2	0.000000	0.999998	
18	CL29	15	6	0.000000	0.999998	
17	CL23	49	3	0.000000	0.999998	
16	CL39	CL19	4	0.000000	0.999998	
15	CL26	34	4	0.000000	0.999997	T
14	21	46	2	0.000000	0.999997	
13	CL18	48	7	0.000000	0.999997	
12	CL32	47	4	0.000000	0.999996	
11	CL17	CL13	10	0.000000	0.999996	
10	CL22	CL12	8	0.000001	0.999995	
9	CL31	38	4	0.000158	0.999837	
8	31	CL15	5	0.000169	0.999669	
7	CL10	CL20	12	0.000562	0.999106	
6	CL11	CL21	18	0.000937	0.998170	
5	CL8	CL9	9	0.000985	0.997185	
4	CL16	CL5	13	0.003488	0.993696	
3	CL7	CL6	30	0.006764	0.986932	
2	CL3	CL4	43	0.194704	0.792228	
1	CL2	CL14	45	0.792228	0.000000	

APPENDIX 6

A Sample of the Input CSV File

ANNUAL PATR SUMMARY TABLE FOR,,,,1995,,,Total number of stations,,,49
"(1=Sunday, 2=Monday, 3=Tuesday, 4=Wednesday, 5=Thursday, 6=Friday, 7=Saturday)",,,,,,,Total number of clusters
"STATION 1: 'RURAL - 1, PRINCIPAL ARTERIAL - INTERSTATE"

PATR #1,,,"I-64, SUMMERS COUNTY",,,,Cluster:,,,Functional Code: ,,1

DATE,,DAY,JAN,DAY,FEB,DAY,MAR,DAY,APR,DAY,MAY,DAY,JUN,DAY,JUL,DAY,AUG,DAY,SEP,DAY,OCT,DAY,NOV,DAY,DEC
1,,1,7507,4,6815,4,7174,7,8464,2,8068,5,9658,7,15589,3,10073,6,15086,1,10298,4,8050,6,8701
2,,2,8508,5,7181,5,,1,8579,3,7945,6,11331,1,11500,4,10335,7,11603,2,8843,5,8831,7,7423
3,,3,7582,6,7847,6,,2,7890,4,8320,7,9811,2,10153,5,11740,1,9466,3,8536,6,10321,1,7263
4,,4,7002,7,2921,7,,3,7661,5,9425,1,10124,3,10139,6,14280,2,13682,4,9002,7,8077,2,7244
5,,5,7600,1,4624,1,,4,8008,6,11001,2,9253,4,11021,7,12779,3,9635,5,9357,1,8732,3,7215
6,,6,5885,2,5164,2,,5,8835,7,8374,3,8802,5,10518,1,13573,4,7979,6,12447,2,7950,4,7503
7,,7,4382,3,5963,3,7903,6,10349,1,9896,4,8770,6,12166,2,10838,5,9435,7,9502,3,7663,5,6670
8,,1,6194,4,5368,4,5465,7,8688,2,8578,5,9252,7,,3,10452,6,11256,1,10508,4,7652,6,8469
9,,2,6175,5,6702,5,6933,1,9224,3,8009,6,12334,1,12383,4,10466,7,9050,2,9961,5,8896,7,4605
10,,3,,6,7528,6,9783,2,,4,8469,7,10869,2,7652,5,12248,1,10104,3,8885,6,10474,1,6290
11,,4,,7,6111,7,7916,3,,5,9680,1,10882,3,7232,6,16876,2,8660,4,9026,7,6804,2,6759
12,,5,,1,6537,1,8451,4,,6,11708,2,9509,4,7490,7,17224,3,8477,5,10333,1,8169,3,7294
13,,6,,2,6683,2,7575,5,11038,7,9292,3,9212,5,8269,1,18156,4,8772,6,12861,2,6999,4,7161
14,,7,6992,3,6745,3,7449,6,13246,1,9846,4,9062,6,9212,2,14094,5,9409,7,9957,3,5614,5,8357
15,,1,5917,4,5655,4,7925,7,8977,2,9287,5,10390,7,8843,3,12973,6,11329,1,11575,4,5622,6,10182
16,,2,7932,5,7450,5,8626,1,10001,3,8530,6,12988,1,8824,4,13963,7,9194,2,9296,5,8119,7,8724
17,,3,7045,6,9498,6,10175,2,11186,4,8626,7,12037,2,6976,5,14036,1,9819,3,9437,6,10632,1,7995
18,,4,6692,7,7367,7,8121,3,9373,5,9199,1,12069,3,6752,6,16385,2,8950,4,9164,7,9616,2,7930
19,,5,6915,1,7270,1,9511,4,8995,6,10898,2,9915,4,6842,7,14832,3,8659,5,10228,1,8715,3,8505
20,,6,6857,2,8660,2,7910,5,9703,7,8787,3,9006,5,7968,1,13641,4,8667,6,12293,2,8281,4,8126
21,,7,4302,3,6736,3,7676,6,11198,1,9921,4,9863,6,10670,2,10449,5,9626,7,9339,3,10174,5,10412
22,,1,5292,4,6984,4,7668,7,8928,2,8908,5,10498,7,9365,3,9742,6,11489,1,10737,4,17007,6,12841
23,,2,6360,5,7689,5,8236,1,10446,3,8474,6,12651,1,10191,4,,7,8889,2,8800,5,8955,7,11604
24,,3,5753,6,8402,6,9803,2,8304,4,8736,7,11226,2,8307,5,10368,1,9932,3,8890,6,8919,1,5899
25,,4,6388,7,6810,7,8410,3,8044,5,10423,1,11963,3,6776,6,12022,2,8838,4,8747,7,11858,2,5819
26,,5,7297,1,7888,1,8907,4,8130,6,14900,2,9388,4,6966,7,10451,3,8636,5,9657,1,17569,3,
27,,6,7965,2,6845,2,7856,5,8828,7,11456,3,6867,5,8459,1,10810,4,8700,6,11229,2,8708,4,
28,,7,3821,3,7477,3,7896,6,10278,1,9248,4,9127,6,10904,2,9161,5,9277,7,8436,3,7905,5,
29,,1,4616,,,4,8104,7,8072,2,13194,5,10611,7,11549,3,8700,6,11857,1,9175,4,7231,6,9207
30,,2,4973,,,5,8460,1,8799,3,9924,6,15446,1,12797,4,9090,7,9079,2,8330,5,7547,7,10177

31,,3,6623,,,6,5411,,,4,8861,,,2,10525,5,,,,3,7425,,,1,7157

,TOTAL
,MADT
,Monthly Factor
,Sunday Factor per Month
,Monday Factor per Month
,Tuesday Factor per Month
,Wednesday Factor per Month
,Thursday Factor per Month
,Friday Factor per Month
,Saturday Factor per Months

APPENDIX 7

Listing of Excel Macro to Input Traffic Counts and Compute Factors

Cluster-Crunch Module

```
'
' crunchcat Macro
'
Sub crunchcat()

    Dim catval(12, 7, 2)
    Dim mtotal(12, 2)

    Sheets("Raw-data").Select
    no_of_stat = Cells(1, 11).Value
    no_of_cat = Cells(2, 11).Value

    For c = 1 To no_of_cat

    Sheets("Raw-data").Select

    For i = 1 To 12
        mtotal(i, 1) = 0
        mtotal(i, 2) = 0
        For j = 1 To 7
            For k = 1 To 2
                catval(i, j, k) = 0
            Next k
        Next j
    Next i

    gtotal = 0
    gentries = 0

    For i = 1 To no_of_stat

    If Cells(5 + (i - 1) * 50, 9).Value = c Then


        gtotal = gtotal + Cells(50 * (i - 1) + 40, 27).Value
        gentries = gentries + Cells(50 * (i - 1) + 40, 28).Value
```

```
    For j = 1 To 12
      mtotal(j, 1) = mtotal(j, 1) + Cells(50 * (i - 1) + 40, 4 + 2 * (j - 1)).Value
      mtotal(j, 2) = mtotal(j, 2) + Cells(50 * (i - 1) + 41, 3 + 2 * (j - 1)).Value

      For k = 1 To 7
      If (Cells((42 + k) + (i - 1) * 50, 4 + 2 * (j - 1)).Value <> 0) Then
       catval(j, k, 1) = catval(j, k, 1) + (Cells(50 * (i - 1) + 41, 27).Value / (Cells((42 + k) +
                         (I - 1) * 50, 4 + 2 * (j - 1)).Value)) * (Cells(42 + k + (i - 1) * 50, 3
                         + 2 * (j - 1)).Value)
      catval(j, k, 2) = catval(j, k, 2) + Cells((42 + k) + (i - 1) * 50, 3 + 2 * (j - 1)).Value
      End If
      Next k

    Next j

  End If

  Next i


' first, select the sheet to store the Day of week within month and monthly factors of each
  cluster.....
Sheets("Cluster-sheet").Select

  Application.Run Macro:="factors.xls!get_to_top"
  ActiveCell.Offset(1 + (c - 1) * 20, 0).Range("A1").Select
  Application.Run Macro:="factors.xls!build_table"

  a$ = "Data for Cluster number : " + Str$(c)
  Cells(1 + (c - 1) * 20, 1) = a$

  If gentries > 0 Then

  gmean = gtotal / gentries

  Cells(20 * (c - 1) + 5, 27).Value = gtotal
  Cells(20 * (c - 1) + 6, 27).Value = gmean
  Cells(20 * (c - 1) + 5, 28).Value = gentries

  For i = 1 To 12
     Cells(20 * (c - 1) + 5, 3 + 2 * (i - 1)).Value = mtotal(i, 2)
     Cells(20 * (c - 1) + 5, 4 + 2 * (i - 1)).Value = mtotal(i, 1)
```

```
        If mtotal(i, 2) > 0 And mtotal(i, 1) > 0 Then
        Cells(20 * (c - 1) + 6, 4 + 2 * (i - 1)).Value = mtotal(i, 1) / mtotal(i, 2)
        Cells(20 * (c - 1) + 7, 4 + 2 * (i - 1)).Value = gmean / (mtotal(i, 1) / mtotal(i, 2))
        End If

        For j = 1 To 7
        If catval(i, j, 2) <> 0 Then
        Cells(20 * (c - 1) + 7 + j, 4 + 2 * (i - 1)).Value = gmean / (catval(i, j, 1) / catval(i, j, 2))
        Cells(20 * (c - 1) + 7 + j, 3 + 2 * (i - 1)).Value = catval(i, j, 2)
        End If
        Next j

    Next i

    End If

' Now select the sheet to store the day of week factor....
    Sheets("Cluster-sheet-2").Select
    Application.Run Macro:="factors.xls!get_to_top"
    ActiveCell.Offset(2 + (c - 1) * 2, 0).Range("A1").Select
    Application.Run Macro:="factors.xls!build_table_2"

    If (gentries = 0) Then gmean = 0 Else gmean = gtotal / gentries

    Cells(3 + (c - 1) * 2, 1).Value = c
    For i = 1 To 7
      day_num = 0
      day_den = 0
        For j = 1 To 12
          day_num = day_num + catval(j, i, 1)
          day_den = day_den + catval(j, i, 2)
        Next j
      If (day_den > 0 And day_num > 0) Then
      Cells(3 + (c - 1) * 2, 1 + i).Value = gmean / (day_num / day_den)
      End If
    Next i

    Next c
    Sheets("Raw-data").Select
    Application.Run Macro:="factors.xls!get_to_top"
    Sheets("Cluster-sheet").Select
    Application.Run Macro:="factors.xls!get_to_top"
    Sheets("Cluster-sheet-2").Select
```

```
    Application.Run Macro:="factors.xls!get_to_top"

End Sub

'
' Build_table Macro
'
Sub Build_table()
   ActiveCell.Offset(2, 2).Range("A1").Select
   ActiveCell.FormulaR1C1 = "Day"
   ActiveCell.Offset(0, 1).Range("A1").Select
   ActiveCell.FormulaR1C1 = "Jan"
   ActiveCell.Offset(0, 1).Range("A1").Select
   ActiveCell.FormulaR1C1 = "Day"
   ActiveCell.Offset(0, 1).Range("A1").Select
   ActiveCell.FormulaR1C1 = "Feb"
   ActiveCell.Offset(0, 1).Range("A1").Select
   ActiveCell.FormulaR1C1 = "Day"
   ActiveCell.Offset(0, 1).Range("A1").Select
   ActiveCell.FormulaR1C1 = "Mar"
   ActiveCell.Offset(0, 1).Range("A1").Select
   ActiveCell.FormulaR1C1 = "Day"
   ActiveCell.Offset(0, 1).Range("A1").Select
   ActiveCell.FormulaR1C1 = "Apr"
   ActiveCell.Offset(0, 1).Range("A1").Select
   ActiveCell.FormulaR1C1 = "Day"
   ActiveCell.Offset(0, 1).Range("A1").Select
   ActiveCell.FormulaR1C1 = "May"
   ActiveCell.Offset(-1, 1).Range("A1").Select
   ActiveCell.FormulaR1C1 = "Day"
   ActiveCell.Select
   Selection.ClearContents
   ActiveCell.Offset(1, 0).Range("A1").Select
   ActiveCell.FormulaR1C1 = "Day"
   ActiveCell.Offset(0, 1).Range("A1").Select
   ActiveCell.FormulaR1C1 = "June"
   ActiveCell.Offset(0, 1).Range("A1").Select
   ActiveCell.FormulaR1C1 = "Day"
   ActiveCell.Offset(0, 1).Range("A1").Select
   ActiveCell.FormulaR1C1 = "July"
   ActiveCell.Offset(0, 1).Range("A1").Select
   ActiveCell.FormulaR1C1 = "Day"
   ActiveCell.Offset(0, 1).Range("A1").Select
```

```
ActiveCell.FormulaR1C1 = "Aug"
ActiveCell.Offset(0, 1).Range("A1").Select
ActiveCell.FormulaR1C1 = "Day"
ActiveCell.Offset(0, 1).Range("A1").Select
ActiveCell.FormulaR1C1 = "Sep"
ActiveCell.Offset(0, 1).Range("A1").Select
ActiveCell.FormulaR1C1 = "Day"
ActiveCell.Offset(0, 1).Range("A1").Select
ActiveCell.FormulaR1C1 = "Oct"
ActiveCell.Offset(0, 1).Range("A1").Select
ActiveCell.FormulaR1C1 = "Day"
ActiveCell.Offset(0, 1).Range("A1").Select
ActiveCell.FormulaR1C1 = "Nov"
ActiveCell.Offset(0, 1).Range("A1").Select
ActiveCell.FormulaR1C1 = "Day"
ActiveCell.Offset(0, 1).Range("A1").Select
ActiveCell.FormulaR1C1 = "Dec"
ActiveCell.Offset(1, -24).Range("A1").Select
ActiveCell.FormulaR1C1 = "Total"
ActiveCell.Offset(1, 0).Range("A1").Select
ActiveCell.FormulaR1C1 = "MADT"
ActiveCell.Offset(1, 0).Range("A1").Select
ActiveCell.FormulaR1C1 = "Monthly Factor"
ActiveCell.Offset(1, 0).Range("A1").Select
ActiveCell.FormulaR1C1 = "Sunday Factor"
ActiveCell.Offset(1, 0).Range("A1").Select
ActiveCell.FormulaR1C1 = "Monday Factor"
ActiveCell.Offset(1, 0).Range("A1").Select
ActiveCell.FormulaR1C1 = "Tuesday Factor"
ActiveCell.Offset(1, 0).Range("A1").Select
ActiveCell.FormulaR1C1 = "Wednesday Factor"
ActiveCell.Offset(1, 0).Range("A1").Select
ActiveCell.FormulaR1C1 = "Tuesday Factor"
ActiveCell.Select
ActiveCell.FormulaR1C1 = "Thursday Factor"
ActiveCell.Offset(1, 0).Range("A1").Select
ActiveCell.FormulaR1C1 = "Friday Factor"
ActiveCell.Offset(1, 0).Range("A1").Select
ActiveCell.FormulaR1C1 = "Saturday Factor"
ActiveCell.Offset(1, 0).Range("A1").Select
ActiveCell.Columns("A:A").EntireColumn.ColumnWidth = 15.7
ActiveCell.Offset(-12, -1).Range("A1").Select
ActiveWindow.SmallScroll ToRight:=18
```

```
    ActiveCell.Offset(3, 27).Range("A1").Select
    ActiveCell.FormulaR1C1 = "AADT"
    ActiveCell.Offset(1, 0).Range("A1").Select
    ActiveCell.FormulaR1C1 = "MCV"
    ActiveCell.Offset(-3, 0).Range("A1").Select
    ActiveWindow.SmallScroll ToRight:=-18
    ActiveWindow.SmallScroll Down:=2
    ActiveCell.Offset(18, -27).Range("A1").Select
    ActiveWindow.SmallScroll Down:=6
End Sub
'
' Get_to_top Macro
'
Sub Get_to_top()
    Range("A1").Select
    Row = ActiveCell.Row
    col = ActiveCell.Column
    ActiveCell.Offset(-Row + 1, -col + 1).Range("A1").Select
End Sub
```

Module 1

```
' inskar Macro

' Keyboard Shortcut: Ctrl+i
'
Sub inskar()
    ActiveCell.Rows("1:1").EntireRow.Select
    Selection.Insert Shift:=xlDown
    Selection.Insert Shift:=xlDown
    Selection.Insert Shift:=xlDown
    Selection.Insert Shift:=xlDown
    ActiveWindow.SmallScroll Down:=11
    ActiveCell.Offset(5, 7).Range("A1").Select
End Sub
'
' Macro2 Macro

' Keyboard Shortcut: Ctrl+r
'
Sub Macro2()
    ActiveCell.Offset(-1, -7).Range("A1").Select
End Sub
```

```
'
' Macro3 Macro

' Keyboard Shortcut: Ctrl+u
'
Sub Macro3()
   Application.Run Macro:="factors.xls!inskar"
   Application.Run Macro:="factors.xls!Macro2"
   Application.Run Macro:="factors.xls!inskar"
   Application.Run Macro:="factors.xls!Macro2"
   Application.Run Macro:="factors.xls!inskar"
   Application.Run Macro:="factors.xls!Macro2"
   Application.Run Macro:="factors.xls!inskar"
   Application.Run Macro:="factors.xls!Macro2"
   Application.Run Macro:="factors.xls!inskar"
   Application.Run Macro:="factors.xls!Macro2"
   Application.Run Macro:="factors.xls!inskar"
   Application.Run Macro:="factors.xls!Macro2"
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   Application.Run Macro:="factors.xls!Macro2"
   Application.Run Macro:="factors.xls!inskar"
   Application.Run Macro:="factors.xls!Macro2"
   Application.Run Macro:="factors.xls!inskar"
   Application.Run Macro:="factors.xls!Macro2"
   Application.Run Macro:="factors.xls!inskar"
   Application.Run Macro:="factors.xls!Macro2"
   Application.Run Macro:="factors.xls!inskar"
   Application.Run Macro:="factors.xls!Macro2"
End Sub
'
' Macro4 Macro

Sub Macro4()
   Application.Run Macro:="factors.xls!inskar"
   ActiveCell.FormulaR1C1 = "Category:"
   ActiveCell.Offset(0, 1).Range("A1").Select
End Sub

' test1 Macro

' Keyboard Shortcut: Ctrl+x
```

```
Sub test1()
   Dim mtotal(12, 2)
   Dim monval(12, 7, 2)

' the first column represents the month.....
' the second column stores the day of the week
' the third column stores the sum of values for a given day in each month in col#1 and # of non-blank
entries in col#2

   For i = 1 To 12
      mtotal(i, 1) = 0
      mtotal(i, 2) = 0
      For j = 1 To 7
         For k = 1 To 2
            monval(i, j, k) = 0
         Next k
      Next j
   Next i

   gtotal = 0
   gentries = 0

   Row = ActiveCell.Row
   col = ActiveCell.Column
   Row = Row + 3
   col = col + 3

   For i = 0 To 30          'represents the date...
      For j = 0 To 22 Step 2  'represents the month...
         a$ = Cells(Row + i, col + j - 1)
         If a$ = "" Then
            GoTo 10
         End If
         b$ = Cells(Row + i, col + j)

         If Val(b$) <> 0 Then
            m = 1 + j / 2
            d = Val(a$)
            monval(m, d, 2) = monval(m, d, 2) + 1
            monval(m, d, 1) = monval(m, d, 1) + Cells(Row + i, col + j).Value
         End If
10       Next j
   Next i
```

```
' now the data has to be processed...
For i = 1 To 12
   For j = 1 To 7
      mtotal(i, 1) = mtotal(i, 1) + monval(i, j, 1)
      mtotal(i, 2) = mtotal(i, 2) + monval(i, j, 2)
   Next j
Next i
For i = 1 To 12
   gtotal = gtotal + mtotal(i, 1)
   gentries = gentries + mtotal(i, 2)
Next i



' the info has to be written onto the spreadsheet....
Row = ActiveCell.Row + 35
col = ActiveCell.Column + 3

gmean = gtotal / gentries

For i = 0 To 22 Step 2
   Cells(Row, col + i).Value = mtotal(1 + (i / 2), 1)
   If mtotal(1 + (i / 2), 2) <> 0 Then
      Cells(Row + 1, col + i).Value = mtotal(1 + (i / 2), 1) / mtotal(1 + i / 2, 2)
      Cells(Row + 1, col + i).Value = mtotal(1 + (i / 2), 1) / mtotal(1 + (i / 2), 2)
      Cells(Row + 1, col + i - 1).Value = mtotal(1 + (i / 2), 2)
      Cells(Row + 2, col + i).Value = gmean / Cells(Row + 1, col + i).Value
   Else
      Cells(Row + 1, col + i).Value = 0
      Cells(Row + 1, col + i - 1).Value = 0
      Cells(Row + 2, col + i).Value = 0
   End If

   j = (i / 2) + 1

   For k = 1 To 7
      If monval(j, k, 1) <> 0 And monval(j, k, 2) <> 0 Then
         Cells(Row + 2 + k, col + i).Value = gmean / (monval(j, k, 1) / monval(j, k, 2))
         Cells(Row + 2 + k, col + i - 1).Value = monval(j, k, 2)
      Else
         Cells(Row + 2 + k, col + i).Value = 0
         Cells(Row + 2 + k, col + i - 1).Value = 0
      End If
```

```
    Next k

  Next i

  Cells(Row, 27).Value = gtotal
  Cells(Row, 28).Value = gentries
  Cells(Row + 1, 27).Value = gmean

End Sub
```

Module 2

```
'
' comrem Macro

' Keyboard Shortcut: Ctrl+c

Sub comrem()
  ActiveCell.Range("A1:AB53").Select
  Selection.ClearContents
  ActiveCell.Rows("1:1").EntireRow.Select
  Selection.Delete Shift:=xlUp
  Selection.Delete Shift:=xlUp
  Selection.Delete Shift:=xlUp
  ActiveCell.Rows("1:50").EntireRow.Select
  Selection.Delete Shift:=xlUp
  ActiveCell.Rows("1:1").EntireRow.Select
  Selection.Insert Shift:=xlDown
  Selection.Insert Shift:=xlDown
  ActiveCell.Offset(1, 0).Rows("1:1").EntireRow.Select
  Selection.Insert Shift:=xlDown
  Selection.Insert Shift:=xlDown
  Selection.Insert Shift:=xlDown
  ActiveCell.Rows("1:2").EntireRow.Select
  Selection.Delete Shift:=xlUp
  ActiveCell.Offset(0, 0).Range("A1").Select
End Sub
'
' Macro5 Macro

' Keyboard Shortcut: Ctrl+j
```

```
Sub Macro5()
   ActiveCell.Offset(50, 0).Range("A1").Select
End Sub
'
' Macro6 Macro

' Keyboard Shortcut: Ctrl+d

Sub Macro6()
   ActiveCell.Range("A1:X10").Select
   Selection.ClearContents
   ActiveCell.Select
   Application.Run Macro:="factors.xls!Macro5"
End Sub

' Cruncher Macro

' Keyboard Shortcut: Ctrl+m

Sub Cruncher()
   Sheets("Raw-data").Select
   no_of_stat = Cells(1, 11).Value
   For i = 1 To no_of_stat
   Application.Run Macro:="factors.xls!test1"
   ActiveCell.Offset(50, 0).Range("A1").Select
   Next i
   ActiveCell.Offset(-50 * no_of_stat, 0).Range("A1").Select
End Sub
```

Delete Module

```
' Macro7 Macro

' Keyboard Shortcut: Ctrl+y
'
Sub Macro7()
   ActiveCell.Offset(35, 3).Range("A1").Select
   Application.Run Macro:="Factors.xls!Macro6"
   Application.Run Macro:="Factors.xls!Macro6"
   Application.Run Macro:="Factors.xls!Macro6"
   Application.Run Macro:="Factors.xls!Macro6"
   Application.Run Macro:="Factors.xls!Macro6"
```

```
Application.Run Macro:="Factors.xls!Macro6"
Application.Run Macro:="Factors.xls!Macro6"
Application.Run Macro:="Factors.xls!Macro6"
Application.Run Macro:="Factors.xls!Macro6"
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Application.Run Macro:="Factors.xls!Macro6"
Application.Run Macro:="Factors.xls!Macro6"
Application.Run Macro:="Factors.xls!Macro6"
```

```
    Application.Run Macro:="Factors.xls!Macro6"
    ActiveWindow.ScrollRow = 1
    ActiveCell.Offset(-2485, -3).Range("A1").Select
End Sub
```

Module 3

```
'
' gen_top_3_rows Macro

' Keyboard Shortcut: Ctrl+a
'
Sub gen_top_3_rows()
    Application.Run Macro:="factors.xls!delete_cluster_sheets"
    Sheets("intro").Select
    Selection.Font.Bold = True
    With Selection.Font
        .Name = "Arial MT"
        .Size = 14
        .Strikethrough = False
        .Superscript = False
        .Subscript = False
        .OutlineFont = False
        .Shadow = False
        .Underline = xlNone
        .ColorIndex = xlAutomatic
    End With
    ActiveCell.FormulaR1C1 = "ANNUAL PATR SUMMARY TABLE :"
    Range("H1").Select
    Selection.Font.Bold = True
    ActiveCell.FormulaR1C1 = "Total number of stations :"
    Range("H2").Select
    Selection.Font.Bold = True
    ActiveCell.FormulaR1C1 = "Total number of clusters :"
    Range("A1").Select
End Sub
'
' gen_layout_for_each_stat Macro
'
Sub gen_layout_for_each_stat()

    Dim mon_days(12)
     y = Cells(1, 6).Value
     t = y - 1995
```

```
tot = 365 * t

For i = 1995 To (y - 1)
   If (i Mod 4) = 0 Then tot = tot + 1
Next i

starting_day = tot Mod 7 + 1

If (y Mod 4) = 0 Then tot_no_of_days = 366 Else tot_no_of_days = 365

mon_days(1) = 31
If (y Mod 4) = 0 Then mon_days(2) = 29 Else mon_days(2) = 28
mon_days(3) = 31
mon_days(4) = 30
mon_days(5) = 31
mon_days(6) = 30
mon_days(7) = 31
mon_days(8) = 31
mon_days(9) = 30
mon_days(10) = 31
mon_days(11) = 30
mon_days(12) = 31

r = ActiveCell.Row
c = ActiveCell.Column

x = r + 3
y = 3
d = starting_day
mon = 1
end_of_mon = mon_days(mon)

For cc = 1 To tot_no_of_days
   If (d Mod 7) = 0 Then Cells(x, y).Value = 7 Else Cells(x, y).Value = d Mod 7

   x = x + 1
   d = d + 1

   If (cc = end_of_mon) Then
      x = r + 3
      y = y + 2
      mon = mon + 1
      If cc < 365 Then end_of_mon = end_of_mon + mon_days(mon)
```

```
    End If

  Next cc

End Sub
'
' build_station_table Macro

' Keyboard Shortcut: Ctrl+y
'
Sub build_station_table()
  ActiveCell.FormulaR1C1 = "PATR"
  ActiveCell.Offset(0, 2).Range("A1").Select
  ActiveCell.FormulaR1C1 = "NAME"
  ActiveCell.Offset(2, -2).Range("A1").Select
  ActiveCell.FormulaR1C1 = "DATE"
  ActiveCell.Offset(1, 0).Range("A1").Select
  ActiveCell.FormulaR1C1 = "1"
  ActiveCell.Offset(1, 0).Range("A1").Select
  ActiveCell.FormulaR1C1 = "2"
  ActiveCell.Offset(1, 0).Range("A1").Select
  ActiveCell.FormulaR1C1 = "3"
  ActiveCell.Offset(1, 0).Range("A1").Select
  ActiveCell.FormulaR1C1 = "4"
  ActiveCell.Offset(1, 0).Range("A1").Select
  ActiveCell.FormulaR1C1 = "5"
  ActiveCell.Offset(1, 0).Range("A1").Select
  ActiveCell.FormulaR1C1 = "6"
  ActiveCell.Offset(1, 0).Range("A1").Select
  ActiveCell.FormulaR1C1 = "7"
  ActiveCell.Offset(1, 0).Range("A1").Select
  ActiveCell.FormulaR1C1 = "8"
  ActiveCell.Offset(1, 0).Range("A1").Select
  ActiveCell.FormulaR1C1 = "9"
  ActiveCell.Offset(1, 0).Range("A1").Select
  ActiveCell.FormulaR1C1 = "10"
  ActiveCell.Offset(1, 0).Range("A1").Select
  ActiveCell.FormulaR1C1 = "11"
  ActiveCell.Offset(1, 0).Range("A1").Select
  ActiveCell.FormulaR1C1 = "12"
  ActiveCell.Offset(1, 0).Range("A1").Select
  ActiveCell.FormulaR1C1 = "13"
  ActiveCell.Offset(1, 0).Range("A1").Select
```

```
ActiveCell.FormulaR1C1 = "14"
ActiveCell.Offset(1, 0).Range("A1").Select
ActiveCell.FormulaR1C1 = "15"
ActiveCell.Offset(1, 0).Range("A1").Select
ActiveCell.FormulaR1C1 = "16"
ActiveCell.Offset(1, 0).Range("A1").Select
ActiveCell.FormulaR1C1 = "17"
ActiveCell.Offset(1, 0).Range("A1").Select
ActiveCell.FormulaR1C1 = "18"
ActiveCell.Offset(1, 0).Range("A1").Select
ActiveCell.FormulaR1C1 = "19"
ActiveCell.Offset(1, 0).Range("A1").Select
ActiveCell.FormulaR1C1 = "20"
ActiveCell.Offset(1, 0).Range("A1").Select
ActiveCell.FormulaR1C1 = "21"
ActiveCell.Offset(1, 0).Range("A1").Select
ActiveCell.FormulaR1C1 = "22"
ActiveCell.Offset(1, 0).Range("A1").Select
ActiveCell.FormulaR1C1 = "23"
ActiveCell.Offset(1, 0).Range("A1").Select
ActiveCell.FormulaR1C1 = "24"
ActiveCell.Offset(1, 0).Range("A1").Select
ActiveCell.FormulaR1C1 = "25"
ActiveCell.Offset(1, 0).Range("A1").Select
ActiveCell.FormulaR1C1 = "26"
ActiveCell.Offset(1, 0).Range("A1").Select
ActiveCell.FormulaR1C1 = "27"
ActiveCell.Offset(1, 0).Range("A1").Select
ActiveCell.FormulaR1C1 = "28"
ActiveCell.Offset(1, 0).Range("A1").Select
ActiveCell.FormulaR1C1 = "29"
ActiveCell.Offset(1, 0).Range("A1").Select
ActiveCell.FormulaR1C1 = "30"
ActiveCell.Offset(1, 0).Range("A1").Select
ActiveCell.FormulaR1C1 = "31"
ActiveCell.Offset(2, 1).Range("A1").Select
ActiveCell.FormulaR1C1 = "TOTAL"
ActiveCell.Offset(1, 0).Range("A1").Select
ActiveCell.FormulaR1C1 = "MADT"
ActiveCell.Offset(1, 0).Range("A1").Select
ActiveCell.FormulaR1C1 = "MONTHLY FACTOR"
ActiveCell.Offset(1, 0).Range("A1").Select
ActiveCell.FormulaR1C1 = "SUNDAY FACTOR"
```

```
ActiveCell.Offset(1, 0).Range("A1").Select
ActiveCell.FormulaR1C1 = "TUESDAY FACTOR"
ActiveCell.Offset(1, 0).Range("A1").Select
ActiveCell.FormulaR1C1 = "WEDNESDAY FACTOR"
ActiveCell.Offset(1, 0).Range("A1").Select
ActiveCell.FormulaR1C1 = "THURSDAY FACTOR"
ActiveCell.Offset(1, 0).Range("A1").Select
ActiveCell.FormulaR1C1 = "FRIDAY FACTOR"
ActiveCell.Offset(1, 0).Range("A1").Select
ActiveCell.FormulaR1C1 = "SATURDAY FACTOR"
ActiveCell.Offset(-5, 0).Range("A1").Select
ActiveCell.FormulaR1C1 = "SUNDAY FACTOR PER MONTH"
ActiveCell.Select
ActiveCell.FormulaR1C1 = "SUNDAY FACTOR "
ActiveCell.Offset(1, 0).Rows("1:1").EntireRow.Select
Selection.Insert Shift:=xlDown
ActiveCell.Offset(0, 1).Range("A1").Select
ActiveCell.FormulaR1C1 = "MONDAY FACTOR"
ActiveCell.Offset(-37, 1).Range("A1").Select
ActiveCell.FormulaR1C1 = "DAY"
ActiveCell.Offset(0, 1).Range("A1").Select
ActiveCell.FormulaR1C1 = "JAN"
ActiveCell.Offset(0, 1).Range("A1").Select
ActiveCell.FormulaR1C1 = "DAY"
ActiveCell.Offset(0, 1).Range("A1").Select
ActiveCell.FormulaR1C1 = "FEB"
ActiveCell.Offset(0, 1).Range("A1").Select
ActiveCell.FormulaR1C1 = "DAY"
ActiveCell.Offset(0, 1).Range("A1").Select
ActiveCell.FormulaR1C1 = "MAR"
ActiveCell.Offset(0, 1).Range("A1").Select
ActiveCell.FormulaR1C1 = "DAY"
ActiveCell.Offset(0, 1).Range("A1").Select
ActiveCell.FormulaR1C1 = "APR"
ActiveCell.Offset(0, 1).Range("A1").Select
ActiveCell.FormulaR1C1 = "DAY"
ActiveCell.Offset(0, 1).Range ("A1").Select
ActiveCell.FormulaR1C1 = "MAY"
ActiveCell.Offset(0, 1).Range("A1").Select
ActiveCell.FormulaR1C1 = "DAY"
ActiveCell.Offset(0, 1).Range("A1").Select
ActiveCell.FormulaR1C1 = "JUN"
ActiveCell.Offset(0, 1).Range("A1").Select
```

```
    ActiveCell.FormulaR1C1 = "DAY"
    ActiveCell.Offset(0, 1).Range("A1").Select
    ActiveCell.FormulaR1C1 = "JUL"
    ActiveCell.Offset(0, 1).Range("A1").Select
    ActiveCell.FormulaR1C1 = "DAY"
    ActiveCell.Offset(0, 1).Range("A1").Select
    ActiveCell.FormulaR1C1 = "AUG"
    ActiveCell.Offset(0, 1).Range("A1").Select
    ActiveCell.FormulaR1C1 = "DAY"
    ActiveCell.Offset(0, 1).Range("A1").Select
    ActiveCell.FormulaR1C1 = "SEP"
    ActiveCell.Offset(0, 1).Range("A1").Select
    ActiveCell.FormulaR1C1 = "DAY"
    ActiveCell.Offset(0, 1).Range("A1").Select
    ActiveCell.FormulaR1C1 = "OCT"
    ActiveCell.Offset(0, 1).Range("A1").Select
    ActiveCell.FormulaR1C1 = "DAY"
    ActiveCell.Offset(0, 1).Range("A1").Select
    ActiveCell.FormulaR1C1 = "NOV"
    ActiveCell.Offset(0, 1).Range("A1").Select
    ActiveCell.FormulaR1C1 = "DAY"
    ActiveCell.Offset(0, 1).Range("A1").Select
    ActiveCell.FormulaR1C1 = "DEC"
    ActiveCell.Offset(34, 2).Range("A1").Select
    ActiveCell.FormulaR1C1 = "AADT"
    ActiveCell.Offset(1, 0).Range("A1").Select
    ActiveCell.FormulaR1C1 = "MCV"
    ActiveCell.Offset(-37, -27).Range("A1").Select
End Sub
'
' Ass_col_wid Macro

' Keyboard Shortcut: Ctrl+x
'
Sub Ass_col_wid()
    Columns("A:AB").Select
    Selection.ColumnWidth = 8.63
    Columns("B:B").Select
    Selection.ColumnWidth = 21.88
    Range("A1").Select
End Sub
'
' build_comp_layout Macro
```

```
' Keyboard Shortcut: Ctrl+w
'
Sub build_comp_layout()
   Application.Run Macro:="factors.xls!gen_layout_for_each_stat"
   Application.Run Macro:="factors.xls!build_station_table"
   ActiveCell.Offset(0, 7).Range("A1").Select
   ActiveCell.FormulaR1C1 = "Cluster"
   ActiveCell.Offset(0, -7).Range("A1").Select
End Sub
'
' setup_layout Macro

' Keyboard Shortcut: Ctrl+b
'
Sub setup_layout()

   no_of_stat = Cells(1, 11).Value

   For i = 1 To no_of_stat
      Application.Run Macro:="factors.xls!build_comp_layout"
      ActiveCell.Offset(50, 0).Range("A1").Select
    Next i
    Application.Run Macro:="factors.xls!get_to_top"
End Sub
'
```

Module 4

```
'
' build_table_2 Macro

Sub build_table_2()
   ActiveCell.Columns("A:K").EntireColumn.Select
   With Selection
      .HorizontalAlignment = xlCenter
      .VerticalAlignment = xlBottom
      .WrapText = False
      .Orientation = xlHorizontal
   End With
   ActiveCell.Select
   ActiveCell.FormulaR1C1 = "Cluster"
   ActiveCell.Offset(0, 1).Range("A1").Select
   ActiveCell.FormulaR1C1 = "Sunday factor"
```

```
    ActiveCell.Offset(0, 1).Range("A1").Select
    ActiveCell.FormulaR1C1 = "Monday factor"
    ActiveCell.Offset(0, 1).Range("A1").Select
    ActiveCell.FormulaR1C1 = "Tuesday factor"
    ActiveCell.Offset(0, 1).Range("A1").Select
    ActiveCell.FormulaR1C1 = "Wednesday factor"
    ActiveCell.Offset(0, 1).Range("A1").Select
    ActiveCell.FormulaR1C1 = "Thursday factor"
    ActiveCell.Offset(0, 1).Range("A1").Select
    ActiveCell.FormulaR1C1 = "Friday factor"
    ActiveCell.Offset(0, 1).Range("A1").Select
    ActiveCell.FormulaR1C1 = "Saturday factor"
    ActiveCell.Offset(0, -7).Columns("A:H").EntireColumn.Select
    Selection.Columns.AutoFit
    ActiveCell.Rows("1:1").EntireRow.Select
    Selection.Font.Bold = True
    ActiveCell.Offset(1, 0).Range("A1").Select
End Sub
```

Module 5

```
' Delete_cluster_sheets Macro
'
Sub Delete_cluster_sheets()
    Sheets("Cluster-sheet").Select
    Cells.Select
    Selection.Clear
    Range("A1").Select
    Sheets("Cluster-sheet-2").Select
    Cells.Select
    Selection.Clear
    Range("A1").Select
    Sheets("Raw-data").Select
    Range("A1").Select
End Sub
```

SAS Module

```
'
' SAS_DOWNLOAD_PROC Macro
' Macro recorded 5/26/97 by Preferred Customer
'
'
```

```
Sub SAS_DOWNLOAD_PROC()
   Dim nos As Integer, i As Integer, j As Integer, fc As String
   Dim patr As String
   Dim fac(12) As Double

   Application.Run Macro:="factors.xls!delete_SAS_UPload_sheet"
   Sheets("Raw-Data").Select

   nos = Cells(1, 11).Value

   For i = 1 To nos
      patr = Cells(50 * (i - 1) + 5, 1).Value
      patr = Right$(patr, Len(patr) - 6)
      fc = Cells(50 * (i - 1) + 5, 13).Value
      For j = 1 To 12
         fac(j) = Cells(50 * (i - 1) + 42, 4 + (j - 1) * 2).Value
      Next j
      Sheets("SAS_upload").Select
      Cells(i, 1).Value = patr
      For j = 1 To 12
         Cells(i, 2).Value = fc
         Cells(i, j + 2).Value = fac(j)
      Next j
      Sheets("Raw-Data").Select
   Next i

End Sub
'
' delete_SAS_Upload_sheet Macro
' Macro recorded 5/26/97 by Preferred Customer
'
'
Sub delete_SAS_Upload_sheet()
   Sheets("SAS_upload").Select
   Cells.Select
   Selection.ClearContents
   Range("A1").Select
End Sub
```

APPENDIX 8

Seasonal Factors for all Clusters

The following seven pages show the factors computed for each cluster based on 1995 traffic count data.

Each page contains information for two clusters, with a continuation on the following page. The last cluster (cluster # 6) does not actually exist. It is an extra cluster that contains all sites that were not used in forming the clusters (due to insufficient data). The last two columns contain, on the first line, the total volume and total number of days for which data were recorded during the year. On the second line the AADT is entered.

The last page contains the day-of-the-week factors for each of the clusters.

Data for Cluster number : 1

	Day	Jan	Day	Feb	Day	Mar	Day	Apr	Day	May	Day	June	Day	July
Total	76	2031035	89	2591280	80	2682778	68	2457288	114	3830058	89	3145027	97	3510943
MADT		26724.14		29115.51		33534.73		36136.59		33597		35337.38		36195.29
Monthly Factor		1.230498		1.129433		0.980596		0.909992		0.978778		0.930573		0.908516
Sunday Factor	15	1.567558	12	1.442909	9	1.122866	13	1.075926	15	1.151611	12	1.031318	16	0.966562
Monday Factor	15	1.197414	13	1.127912	9	0.998968	7	0.929767	18	0.995922	12	0.99399	16	0.972986
Tuesday Factor	12	1.148492	13	1.118598	12	0.996287	7	0.930091	18	1.008173	12	1.017141	12	1.029655
Wednesday Factor	8	1.096888	13	1.133408	16	1.057655	8	0.919193	18	0.996559	11	0.984594	12	0.958853
Thursday Factor	8	1.064113	13	1.037728	13	0.992626	10	0.859935	15	0.946753	15	0.916299	12	0.914391
Friday Factor	8	1.14192	12	0.937069	12	0.819376	10	0.773723	15	0.80431	15	0.774793	13	0.781776
Saturday Factor	10	1.350989	13	1.23415	9	0.933209	13	0.907074	15	1.002445	12	0.90691	16	0.806123

Data for Cluster number : 2

	Day	Jan	Day	Feb	Day	Mar	Day	Apr	Day	May	Day	June	Day	July
Total	187	1362040	190	1411448	165	1646775	200	2055107	229	2313692	216	2231770	216	2355282
MADT		7283.636		7428.674		9980.455		10275.54		10103.46		10332.27		10904.08
Monthly Factor		1.332615		1.306597		0.972529		0.944601		0.960689		0.939414		0.890151
Sunday Factor	34	1.475778	27	1.372459	20	0.931733	36	0.911512	30	0.990036	29	0.926751	36	0.836366
Monday Factor	34	1.260224	27	1.32923	20	1.051374	26	1.034132	37	0.954368	29	1.020832	35	0.9836
Tuesday Factor	31	1.28498	27	1.309124	25	1.072351	25	1.139262	36	1.068363	27	1.093538	26	1.064007
Wednesday Factor	21	1.267304	27	1.432591	28	1.074689	27	1.047202	37	1.055626	28	1.03934	26	0.998458
Thursday Factor	20	1.180124	28	1.248121	25	0.964797	24	0.891084	29	0.962691	36	0.964136	29	0.922877
Friday Factor	20	1.178827	27	1.055158	27	0.812669	27	0.779496	30	0.749587	37	0.772507	29	0.762795
Saturday Factor	27	1.719888	27	1.505273	20	0.967619	35	0.926058	30	0.986618	30	0.899163	35	0.793454

Cluster number 1 (continued)

Day	Aug	Day	Sep	Day	Oct	Day	Nov	Day	Dec		
115	4138774	83	2879958	91	2945612	86	2642554	76	2133285	34988592	1064
	35989.34		34698.29		32369.36		30727.37		28069.54	32884.02	AADT
	0.913715		0.947713		1.015899		1.070186		1.17152		
15	0.965543	11	1.1096	15	1.090451	11	1.06625	12	1.414113		
15	0.956806	11	0.947654	15	1.058716	12	1.113614	11	1.279583		
20	0.985191	10	0.979382	15	1.075149	11	1.07355	10	1.072653		
20	0.963462	11	0.974336	12	1.056045	14	1.058874	9	1.229386		
15	0.885296	11	0.949664	10	0.950073	15	1.157404	8	1.215102		
15	0.7815	14	0.788483	12	0.853436	12	0.948621	13	1.013517		
15	0.859557	15	0.985594	12	1.021198	11	1.079529	13	1.107633		

Cluster number 2 (continued)

Day	Aug	Day	Sep	Day	Oct	Day	Nov	Day	Dec		
222	2575379	216	2103164	230	2279042	232	2258224	222	1916437	24508360	2525
	11600.81		9736.87		9908.878		9733.724		8632.599	9706.281	AADT
	0.83669		0.996858		0.979554		0.997181		1.124375		
30	0.75114	29	1.032121	36	0.940437	31	0.86804	38	1.339838		
28	0.89153	29	0.998727	36	1.041145	32	1.08609	29	1.244802		
37	1.004915	29	1.108931	38	1.07675	30	1.091276	26	1.119123		
37	0.969517	29	1.135554	30	1.06343	39	1.03168	25	1.137195		
30	0.842803	28	1.067437	30	1.003773	38	1.078403	27	1.106078		
30	0.68935	36	0.805788	30	0.787257	31	0.87395	38	0.934587		
30	0.752104	36	0.974317	30	0.985313	31	0.984809	39	1.098658		

Data for Cluster number : 3

	Day	Jan	Day	Feb	Day	Mar	Day	Apr	Day	May	Day	June	Day	July
Total	237	1249675	414	2190353	204	1347581	378	2360811	546	3428867	467	2826976	506	3173280
MADT		5272.89		5290.708		6605.789		6245.532		6279.976		6053.482		6271.304
Monthly Factor		1.127128		1.123332		0.899699		0.951596		0.946376		0.981785		0.947685
Sunday Factor	38	1.568611	60	1.395635	27	1.084229	64	1.134693	71	1.118313	64	1.157218	84	1.093159
Monday Factor	40	1.146471	60	1.105366	25	0.889757	48	0.914087	88	0.968116	63	0.986975	82	0.947171
Tuesday Factor	41	1.030156	58	1.058493	25	0.884561	49	0.913229	87	0.931333	63	0.978042	65	0.98855
Wednesday Factor	24	1.034203	57	1.10982	31	0.902796	53	0.946131	89	0.938406	60	1.011056	62	0.898295
Thursday Factor	28	0.964529	59	1.070331	32	0.88102	51	0.939081	71	0.924207	76	0.962227	64	0.89716
Friday Factor	31	0.974051	59	0.987989	37	0.802385	51	0.854701	70	0.83707	80	0.866351	66	0.843093
Saturday Factor	35	1.282406	61	1.213215	27	0.940504	62	0.958841	70	0.947906	61	0.992766	83	0.963708

Data for Cluster number : 4

	Day	Jan	Day	Feb	Day	Mar	Day	Apr	Day	May	Day	June	Day	July
Total	95	2892658	68	1748842	67	2000637	52	1644026	65	2097843	84	3133779	109	4440297
MADT		30449.03		25718.26		29860.25		31615.88		32274.51		37306.89		40736.67
Monthly Factor		1.140682		1.350506		1.163174		1.098583		1.076164		0.930999		0.852614
Sunday Factor	16	1.514231	10	1.915588	9	1.268192	9	1.165495	9	1.177206	12	1.045265	18	0.934165
Monday Factor	17	1.139497	9	1.351483	7	1.138275	5	1.027035	10	1.073032	12	0.957803	16	0.929433
Tuesday Factor	14	0.988085	9	1.221342	9	1.202382	8	1.147514	11	1.10075	11	1.017341	13	0.98646
Wednesday Factor	11	0.989255	10	1.203597	11	1.255411	7	1.072918	10	1.092088	11	0.937765	14	0.879746
Thursday Factor	12	0.980752	10	1.183985	11	1.213045	7	1.164599	8	1.08026	13	0.905095	15	0.828041
Friday Factor	12	1.044722	10	1.107939	12	0.98565	7	0.991828	8	0.903573	14	0.77992	15	0.713687
Saturday Factor	13	1.479274	10	1.878772	8	1.165394	9	1.100365	9	1.121385	11	0.968271	18	0.778077

Cluster number 3 (continued)

Day	Aug	Day	Sep	Day	Oct	Day	Nov	Day	Dec		
499	3185252	525	3207447	520	3246060	467	2417695	419	2163772	30797769	5182
	6383.271		6109.423		6242.423		5177.077		5164.134	5943.221	AADT
	0.931062		0.972796		0.952069		1.147988		1.150865		
64	1.099629	71	1.201396	84	1.145699	63	1.389072	68	1.386098		
67	0.918545	71	1.008373	84	0.943277	62	1.081286	55	1.202705		
84	0.933916	72	0.940945	84	0.941468	61	1.161101	55	1.103942		
84	0.930799	71	0.956726	67	0.936982	76	1.114407	50	1.164296		
67	0.888035	70	0.940632	69	0.915836	78	1.144233	49	1.151286		
67	0.832995	85	0.846099	67	0.814906	64	1.009679	70	0.996067		
66	0.960205	85	1.005157	65	0.99203	63	1.215813	72	1.130621		

Cluster number 4 (continued)

Day	Aug	Day	Sep	Day	Oct	Day	Nov	Day	Dec		
98	3812375	109	4116851	121	4569511	101	3490778	108	3459485	37407082	1077
	38901.79		37769.28		37764.55		34562.16		32032.27	34732.67	AADT
	0.89283		0.919601		0.919716		1.004933		1.084302		
13	0.945867	15	1.085351	20	1.015484	14	0.983564	20	1.458522		
14	0.931021	13	0.939723	20	0.913035	16	0.980375	15	1.228802		
16	0.94952	14	0.942913	20	0.926905	14	1.002278	13	1.005003		
16	0.935064	15	0.955274	16	0.919937	15	0.969838	11	0.997229		
13	0.864321	16	0.8753	15	0.88421	15	1.089331	11	0.935173		
13	0.763278	18	0.758178	15	0.774195	13	0.948878	19	0.889916		
13	0.86969	18	0.983345	15	1.023653	14	1.073212	19	1.144236		

ata for Cluster number : 5

	Day	Jan	Day	Feb	Day	Mar	Day	Apr	Day	May	Day	June	Day	July
Total	156	1335389	187	2066910	130	1343074	155	1698805	265	3158652	262	3036916	268	2979287
MADT		8560.186		11052.99		10331.34		10960.03		11919.44		11591.28		11116.74
Monthly Factor		1.273002		0.985899		1.054765		0.994261		0.914232		0.940115		0.980245
Sunday Factor	26	1.958806	26	1.41149	16	1.342208	25	1.385657	35	1.179158	35	1.192254	44	1.200041
Monday Factor	27	1.283229	25	0.924932	16	1.057198	17	1.005773	43	0.948475	36	0.921971	43	0.937908
Tuesday Factor	26	1.05743	26	0.889174	16	1.020773	19	0.961723	42	0.92959	36	0.916076	33	1.029332
Wednesday Factor	18	1.138835	28	0.98155	21	1.011943	23	0.937381	42	0.852215	35	0.935957	34	0.94161
Thursday Factor	20	1.096429	27	0.91719	23	0.977447	22	0.894401	34	0.906125	43	0.905536	36	0.924594
Friday Factor	16	1.107616	28	0.870157	22	0.987515	21	0.836174	35	0.73823	43	0.832497	35	0.853098
Saturday Factor	23	1.518066	27	1.086844	16	1.146147	28	1.039127	34	0.959235	34	0.986765	43	1.005664

Data for Cluster number : 6

	Day	Jan	Day	Feb	Day	Mar	Day	Apr	Day	May	Day	June	Day	July
Total	28	36597	51	54027	6	6921	42	82897	61	118166	60	119854	60	135280
MADT		1307.036		1059.353		1153.5		1973.738		1937.148		1997.567		2254.667
Monthly Factor		1.364914		1.684039		1.54659		0.903864		0.920937		0.893082		0.791244
Sunday Factor	5	1.48468	7	1.730351	1	1.783992	7	0.852827	8	0.744532	8	0.757373	10	0.677294
Monday Factor	5	1.365369	7	1.791927			5	1.045471	10	0.989842	8	1.010474	9	0.899391
Tuesday Factor	4	1.331089	7	1.772848			5	1.042782	10	1.111521	8	1.011763	7	0.923869
Wednesday Factor	3	1.292435	8	1.793182	1	1.977818	6	1.018066	9	1.122243	8	1.016737	8	0.892609
Thursday Factor	3	1.31952	8	1.547261	2	1.239744	6	0.963192	8	1.036903	10	0.980431	8	0.897042
Friday Factor	4	1.233742	7	1.442859	1	1.715376	6	0.792122	8	0.814469	10	0.788226	8	0.731519
Saturday Factor	4	1.513782	7	1.794502	1	1.620337	7	0.779133	8	0.738331	8	0.796692	10	0.681902

Cluster number 5 (continued)

Day	Aug	Day	Sep	Day	Oct	Day	Nov	Day	Dec		
266	3017897	269	3011083	241	2662649	263	2761561	243	2404532	29476755	2705
	11345.48		11193.62		11048.34		10500.23		9895.193	10897.14	AADT
	0.960483		0.973513		0.986315		1.0378		1.101256		
36	1.21786	36	1.281434	40	1.280502	35	1.343577	40	1.424858		
35	0.928048	36	1.003807	40	0.958163	35	0.973145	34	1.13171		
43	0.929845	36	0.933434	38	0.942989	35	1.00647	32	1.080261		
44	0.944255	35	0.941686	31	0.935903	44	1.008313	28	1.023404		
36	0.90968	36	0.905629	31	0.91582	44	1.033884	27	1.062444		
36	0.856078	45	0.844467	30	0.860407	35	0.914115	41	0.950262		
36	1.022669	45	1.032402	31	1.060828	35	1.088768	41	1.108108		

Cluster number 6 (continued)

Day	Aug	Day	Sep	Day	Oct	Day	Nov	Day	Dec		
60	126273	60	116289	61	121989	51	76765	52	61065	1056123	592
	2104.55		1938.15		1999.82		1505.196		1174.327	1783.992	AADT
	0.847683		0.920461		0.892076		1.185222		1.519161		
8	0.719823	8	0.789464	10	0.731504	8	1.129287	9	1.865233		
8	0.961785	8	0.968902	10	1.037506	7	1.350778	7	1.696962		
10	0.979139	8	1.119982	9	1.083323	6	1.355102	7	1.626246		
10	0.946867	8	1.090626	8	1.011118	8	1.2432	6	1.524345		
8	0.906385	8	1.110224	8	0.976593	7	1.237655	5	1.364325		
8	0.752104	10	0.831465	8	0.772709	7	1.002001	9	1.274381		
8	0.719932	10	0.764317	8	0.776239	8	1.10208	9	1.425926		

Day-of-the-Week Factors

Cluster	Sunday factor	Monday factor	Tuesday factor	Wednesday factor	Thursday factor	Friday factor	Saturday factor
1	1.136987395	1.040495478	1.034161053	1.024968853	0.97509197	0.845906913	0.985271396
2	0.992869991	1.05848373	1.109334735	1.082622683	1.004453076	0.825003396	0.988665111
3	1.204730283	0.997917107	0.981352193	0.984724079	0.9676623	0.880533004	1.032092475
4	1.144200136	1.020120928	1.012270526	0.991784183	0.963944409	0.853555088	1.052062173
5	1.311697107	0.988080763	0.966343938	0.956801464	0.945379433	0.868204618	1.060109907
6	0.898253272	1.106751727	1.146906328	1.118422416	1.070521809	0.888781694	0.882126981